REPORT

Human Health and Ecological Risk Assessment

Whale Tail Pit - Expansion Project

Submitted to:

Agnico Eagle Mines Limited

Prepared by:

Golder Associates Ltd.

19115196-306-RPT-Rev0

May 2019

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1.0 INTRODUCTION

This report was prepared by Golder Associates Ltd. (Golder), on behalf of Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle), to summarize the potential risks to human health and the environment as a result of the impacts of the expansion of Whale Tail Pit, development of the IVR Pit, and underground operations (Expansion Project or Project). The Expansion Project is presented in the form of an Addendum to the Whale Tail Pit Project (Approved Project).

This Human Health and Ecological Risk Assessment (HHERA) addresses the requirements of the EIS Guidelines for the Meadowbank Mine (NIRB 2004) in terms of assessing potential risks to human health, wildlife, and aquatic life as a result of changes to environmental quality from the predicted emissions and discharges from the Project. Changes to environmental quality include direct effects to air quality and water quality, and indirect effects to soil quality, vegetation quality, and traditional food quality including fish and wild game, such as caribou.

The HHERA follows the principles of risk assessment frameworks from such agencies as Health Canada (e.g., Health Canada 2012), Canadian Council of Ministers of the Environment (CCME 1996, 1997), and United States Environmental Protection Agency (U.S. EPA 1989).

A summary of the key changes to the assessment of the HHERA for the Expansion Project compared to the FEIS developed for the Approved Project is provided in Table 1.

Table 1: Human Health and Ecological Risk Assessment: Approved Project vs Expansion Project Comparison

Section of EIS	Approved Project	Expansion Project
1.1 Valued Components	Review of • Whale Tail Pit Project IQ Baseline Report (Volume 7, Appendix 7-A, Agnico Eagle 2016a); • Meadowbank Mine Baseline Traditional Knowledge Report (Cumberland 2005a); • Proposed All-weather Exploration Road from the Meadowbank Mine to the Project Site-Baseline Traditional Knowledge Report (Agnico Eagle 2014a); • Community Consultations/Public Information Meeting Summary Reports for 2014 and 2015 (NIRB 2014, 2015).	• Whale Tail Pit Open House. Naujaat (Agnico Eagle 2016b) • Whale Tail Pit Amendment July 10-13 Community Consultation Notes (Agnico Eagle 2018a)
2.0 Existing Environment and Baseline	Baseline data were adopted from other disciplines: • Air Quality • Water Quality	No new baseline data specifically for the HHERA
3.0 Effects Assessment for Human Health	Effects to human health included consideration of changes to: • Air Quality • Soil Quality • Country Foods Quality • Water Quality • Fish Tissue Quality	No new primary pathways identified New activities such as underground mining, additional open pit, overall water management, have been added to the primary pathways that were assessed in the Approved Project. Results of the effects assessment were updated for the Expansion Project

Section of EIS	Approved Project	Expansion Project
4.0 Effects Assessment for Wildlife	Effects to wildlife health included consideration of changes to: • Air Quality • Soil Quality • Country Foods Quality • Water Quality • Fish Tissue Quality	Unchanged
5.0 Effects Assessment for Aquatic Life	Effects to aquatic health included consideration of changes to Water Quality	No new primary pathways identified Results of the effects assessment were updated for the Expansion Project
6.0 Residual Impact Classification	Residual impacts were identified for: • Aquatic Life: Aluminum and chromium	Residual impacts were identified for: • Human Health: 1-hour NO_2, arsenic in water quality and fish tissue quality • Aquatic Life: Aluminum, arsenic and chromium
7.0 Cumulative Effects Assessment	Cumulative effects were addressed under the air quality and water quality disciplines.	Unchanged
8.0 Uncertainty	Uncertainties were quantified for human health, wildlife and aquatic life, resulting in an overall overestimation of potential exposure and risk.	Unchanged
9.0 Monitoring and Follow-up	No additional requirements for monitoring and follow-up were identified for human health	Unchanged Recommendations for monitoring of air quality and water/fish tissue quality (arsenic) under the Atmospheric Environment and Water Quality sections of the EIS were recommended for the Approved Project and continue to be recommended for the Expansion Project.

1.1 Valued Components

In broad terms, changes to environmental quality as predicted by other disciplines were quantitatively evaluated for each of the valued components (VCs) described below for human health (Table 1.1-1), wildlife (Table 1.1-2), and aquatic life (Table 1.1-3).

Table 1.1-1: Valued Components and Rationale for Selection – Human Health

	Valued Component		Rationale for Selection
Health and Safety	Workers	Inuit	Inuit may be employed at the mine and reside at the accommodations provided at Whale Tail Pit
		Non-Inuit	Non-Inuit may be employed at the mine and reside at the accommodations provided at Whale Tail Pit
	Public	Inuit	Inuit are known to reside in Baker Lake and use the lands around Whale Tail Pit for hunting, gathering, and other traditional purposes
		Non-Inuit	Non-Inuit are known to reside in Baker Lake and may use the area around Whale Tail Pit for recreational purposes.

While the health of workers was initially identified as a VC for human health, worker health was not quantitatively evaluated in the human health risk assessment (HHRA). It was considered that worker health and safety would comply with all applicable occupational health and safety requirements. Additionally, potable water will be supplied from Nemo Lake, which is not proposed to undergo Project-related changes to water quality. As a result, only members of the public were retained in the HHRA.

Table 1.1-2: Valued Components – Wildlife

Valued Component	Species Identified	Receptor Evaluated in HHERA
Ungulates	Barren-ground caribou, muskox	Barren-ground caribou
Predatory Mammals	Grizzly bear, wolverine, Arctic wolf	Wolverine
Raptors	Peregrine falcon, gyrfalcon, rough-legged hawk, short-eared owl, snowy owl	Peregrine falcon
Water Birds	Common loon, red-throated loon, pacific loon, yellow-billed loon, Canada goose, snow goose, long-tailed duck	Common loon, Canada goose
Upland Birds	Lapland longspur, horned lark, savanna sparrow, rock ptarmigan, red-necked phalarope, semipalmated sandpiper	Rock ptarmigan, semipalmated sandpiper
Small Mammals	Arctic hare, Arctic ground squirrel (Sik Sik), collared lemming, northern red-backed vole	Arctic hare, Arctic ground squirrel (Sik Sik)

Note: Species of concern (national, territorial or Committee on Status of Endangered Wildlife in Canada [COSEWIC] status) are indicated with underlined text.

Receptor characteristics (including established body weights, food ingestion rates, and other key factors) are not available for all of the species identified as VCs. As a result, representative species for which receptor characteristics are available were selected for assessment in the HHERA, and only one receptor was selected to represent each feeding guild.

Table 1.1-3: Valued Components and Rationale for Selection – Aquatic Life

Valued Component	Rationale for Selection
Fish (Arctic Char, Arctic Grayling[a], Lake Trout, Round Whitefish)	■ Fish are an important food source for the residents of Baker Lake and fishing activities occur year round ■ Fish are a prey item for piscivorous wildlife ■ Several forage and sport fish species were identified in the Project area
Aquatic Invertebrates	■ Includes planktonic and benthic invertebrates; benthic invertebrates play a vital role in nutrient cycling and the breakdown of detritus in the aquatic environment; important food source for fish; sensitive to contamination; various species identified in Project area
Aquatic Plants and Algae	■ Important food source for fish; aquatic plants provide habitat to other aquatic organisms; various species identified in the Project area

(a) The Arctic Grayling is classified as a sensitive species in the Northwest Territories.

1.2 Spatial and Temporal Boundaries

The spatial and temporal boundaries as defined by air quality and water quality were adopted for the HHERA (Volume 4, Section 4.1.2.2 and Volume 6, Section 6.1.2.1.2 of the FEIS Addendum; Agnico Eagle 2018b).

1.3 Pathway Analysis

The evaluation of Project effects on human health, wildlife and aquatic life considers the changes to measurement indicators and associated pathways (Table 1.3-1).

Table 1.3-1: Measurement Indicators and Pathways for the Human Health and Ecological Risk Assessment

Measurement Indicator	Associated Primary Pathway
Changes to Air Quality	■ Fugitive dust sources and deposition of dust (including from blasting during mining) can change water and sediment quality, which may affect the health of terrestrial life, aquatic life, human food and water sources including country foods ■ Air emission of sulphur dioxide, nitrogen oxides, and particulates may change water and sediment quality, which may affect the health of terrestrial life, aquatic life, human food and water sources including country foods ■ Project activities will result in air emissions, which may cause changes in air concentrations and, as a result, soil concentrations, which may affect the health of terrestrial life ■ Project vehicles along the haul road will result in air emissions, which may cause changes in air concentrations and as a result, soil concentrations which may affect the health of terrestrial life ■ Fuel combustion will result in air emissions, which may contribute to territorial and national greenhouse gas emissions, which may directly affect human health ■ Changes in air concentrations may also result in alterations to soil concentrations, which may affect human food and water sources including country foods
Changes to Water Quality	■ Project footprint, which will physically alter watershed areas and drainage patterns, rates, and quantities of diverted non-contact water to new watersheds, may change downstream flows, water levels, channel/bank stability in streams and may affect water and sediment quality, which may affect the health of terrestrial life, aquatic life, human food and water sources including country foods ■ Dewatering of lakes may change flows, water levels, channel/bank stability, and water quality (e.g., suspended sediments, nutrients, metals) in receiving and downstream waterbodies, which may affect the health of terrestrial, aquatic life, human food and water sources including country foods

Measurement Indicator	Associated Primary Pathway
	■ Release of mine wastewater (including sewage) may cause changes to surface water quality and sediment quality (i.e., nutrient and metal concentrations), which may affect the health of terrestrial, aquatic life, human food and water sources including country foods ■ Water quality in flooded pits may be higher than objectives and reconnection of drainages may affect downstream water and sediment quality, which may affect the health of terrestrial, aquatic life, human food and water sources including country foods
Changes to Noise	■ Sensory disturbance (i.e., noise) can directly affect human health ■ Sensory disturbance (i.e., noise) can indirectly affect human health by affecting migration patterns of wildlife populations (e.g., caribou) and subsequently human food sources including country foods

Previous risk assessments have been completed at the Meadowbank Mine in 2006 and 2014 (Wilson Scientific Consulting Inc. 2006; Azimuth 2006; Agnico Eagle 2012, 2015a, b), which have assessed the potential risks to human health and wildlife as a result of changes to soil quality (metals) due to dust deposition from the ongoing Meadowbank operations and have been considered herein, where applicable.

As indicated in Volume 7, Section 7.3 of the Approved Project (Agnico Eagle 2016c), the FEIS for the Meadowbank Mine (Cumberland 2005) predicted that the construction of the mine would result in temporary nuisance effects on people's quality of life, as related to dust, noise, changes in air quality and visual disturbances. This prediction was related to construction of infrastructure at the mine (e.g., fuel tank farm, lay down and warehouse facilities, transportation of infrastructure construction equipment) and the road, and was considered to be of low significance given mitigation and the duration of effects. The Approved and Expansion Project will use existing infrastructure at the Meadowbank Mine, and on-site construction activities of the Expansion Project are expected to be similar or less than those generated for the Meadowbank Mine. Additionally, as indicated in Volume 4, Section 4.4.3 of the FEIS Addendum (Agnico Eagle 2018b, noise levels will either decay to ambient noise levels or be compliant with AER Directive 038 Criteria at the local study area boundary during construction and operations, with the exception of blasting, which will comply with NPC-119. While members of the public may potentially pass through the Project area on-route to traditional or cultural sites or access other important traditional areas, the public is expected to be primarily outside the local study area (LSA), with limited exposure to noise over ambient levels or the AER Directive 038 Criteria. Based on the wildlife assessment (Volume 5, Section 5.5.4.1; Agnico Eagle 2018b) noise impacts will have a moderate effect on wildlife over the medium-term but are reversible at closure. Based on the results of the noise assessment and wildlife assessment, noise was considered a secondary pathway in the HHERA for both human health and wildlife and was not assessed further.

To complete the effects assessment for the measurement indicators identified above, the following environmental media were assessed with respect to potential changes to environmental quality that may have an effect on human health, wildlife and aquatic life:

- air quality, which was predicted for receptor locations in the LSA by the air quality discipline;
- soil quality, which was calculated based upon predicted deposition rates;
- country food quality, which was calculated based upon changes to soil (and vegetation) quality;
- water quality, which was predicted for waterbodies in the LSA by the water quality discipline; and

- fish tissue quality, which was calculated based upon changes to water quality.

Although changes to sediment quality were identified in the pathways analysis table above (Table 1.3-1), sediment quality was not assessed in the HHERA as changes to sediment quality were assessed qualitatively and no significant changes were identified (Volume 6, Section 6.2; Agnico Eagle 2018b).

Predicted changes to environmental media were assessed (modeled) by other disciplines for one or more phases of the Project as appropriate (Table 1.3-2).

Table 1.3-2: Phases Modelled for Environmental Quality Predictions

Environmental Medium	Project Phases			
	Construction	Operations	Closure (pit flooding, maintenance)	Post-Closure
Air quality	○	●	—	○
Soil quality[(a)]	○	●	—	○
Country foods quality[(a)]	○	●	—	○
Water quality[(b)]	○	●	●	●
Fish quality[(c)]	○	●	●	●

(a) Potential changes to soil quality and country foods quality were calculated in the HHERA using predicted concentrations of metals in dustfall modelled by air quality.

(b) Potential changes to water quality varied from water body to water body; therefore, each water body was assessed individually in the effects assessment.

(c) Potential changes to fish tissue quality were calculated in the HHERA using predicted changes to water quality.

— = Phase not considered; ○ = Phase considered, but not assessed; ● = Phase assessed.

Mitigation measures were incorporated into the predictive modelling for changes to air quality and surface water quality. The mitigation measures are described in detail in the relevant sections of the FEIS Addendum. No additional mitigation measures were considered in the HHERA.

1.4 Incorporation of Inuit Qaujimajatuqangit Feedback

Additional IQ and concerns related to human health or ecological risk were provided by community members since the FEIS submission was made in 2016 for the Approved Project. This assessment considers review of community consultation notes from Agnico Eagle (2018a, 2018c), NIRB and NWB (2017), and NIRB (2017).

The following comments and concerns have been raised by community members related to potential contamination of food sources, drinking water and effects on human health:

- The potential contamination of food sources that Chesterfield Inlet residents rely on (e.g., whales and seals) because of an oil spill in the marine environment (Agnico Eagle 2017, 2018a).
- The potential human health effects associated with road dust (NIRB and NWB 2017).
- The potential contamination of caribou meat because of the effects of mine operations, dust and dust suppressants on caribou habitat and their food sources, which may affect human health (NIRB and NWB 2017, NIRB 2017); specifically concerns were raised about gastrointestinal issues experienced by community members every year in the spring which is believed to potentially be linked to caribou ingesting chemicals used

in dust suppressants (Agnico Eagle 2018c). It was requested that studies are conducted to determine the effects of mining activities on caribou health (NIRB and NWB 2017; NIRB 2017).

- The safety of drinking water taken from lakes near the camps used during operations (NIRB and NWB 2017) and at closure, specifically confidence in the water quality in the pits, including after the dike is breached (NIRB 2017).

Potential contamination of food sources, such as whales and seals, due to an oil spill in the marine environment is addressed in the Marine Environment Environmental Summary (Appendix 3-A; Agnico Eagle 2018b). Table 3.A-3 indicates that the Shipping Management Plan, Spill Contingency Plan and Emergency Response Plan Volume 8, Appendix 8-D.5 of the Approved Project FEIS outlines measures for spill prevention and response, pollution prevention, and personnel training and competence. The Approved Project also stated that all vessels will have a Shipboard Oil Pollution Emergency Plan (SOPEP) or a Shipboard Marine Pollution Emergency Plan in accordance with MARPOL 73/78, Annex I, IMO Res. MEPC. 78(43) and that each ship has an Emergency Response Team consisting of competent and trained personnel responsible to deal with emergency situations including fire, explosions, and oil spills Therefore, no further assessment within the HHERA was required.

Regarding the potential for human health effects related to road dust and drinking water, these two concerns are evaluated within the HHERA.

Regarding the potential effects to caribou meat due to the use of dust suppressants, this issue was addressed in the Atmospheric Environment FEIS Addendum (Volume 4; Agnico Eagle 2018b). Section 4.3.1.4 Mitigation and Monitoring (Agnico Eagle 2018b) indicated that dust suppressants are being applied in key areas that were identified by community members. Additionally, in Section 4.3.7.1 Dust Mitigation (Agnico Eagle 2018b), it is stated that the use of chemical dust suppressants was initially considered but is not being recommended for the Project. While the human health and ecological effects of these dust suppressants are predicted to be low, they are not native to the Kivalliq region and their long-term effects on Arctic ecosystems has not been evaluated. Chemical suppressants can run off mine and road surfaces during spring melt and during precipitation events with the potential to affect soil or water quality. Therefore, no further assessment within the HHERA was required.

2.0 EXISTING ENVIRONMENT AND BASELINE

The existing environment and baseline conditions, relevant to the HHERA were summarized by other disciplines in the Volumes 4 through 6 of the FEIS Addendum (Agnico Eagle 2018b), with the exception of soil and vegetation quality beyond the Project footprint, provided in Attachment A.

3.0 EFFECTS ASSESSMENT FOR HUMAN HEALTH

3.1 Conceptual Site Model

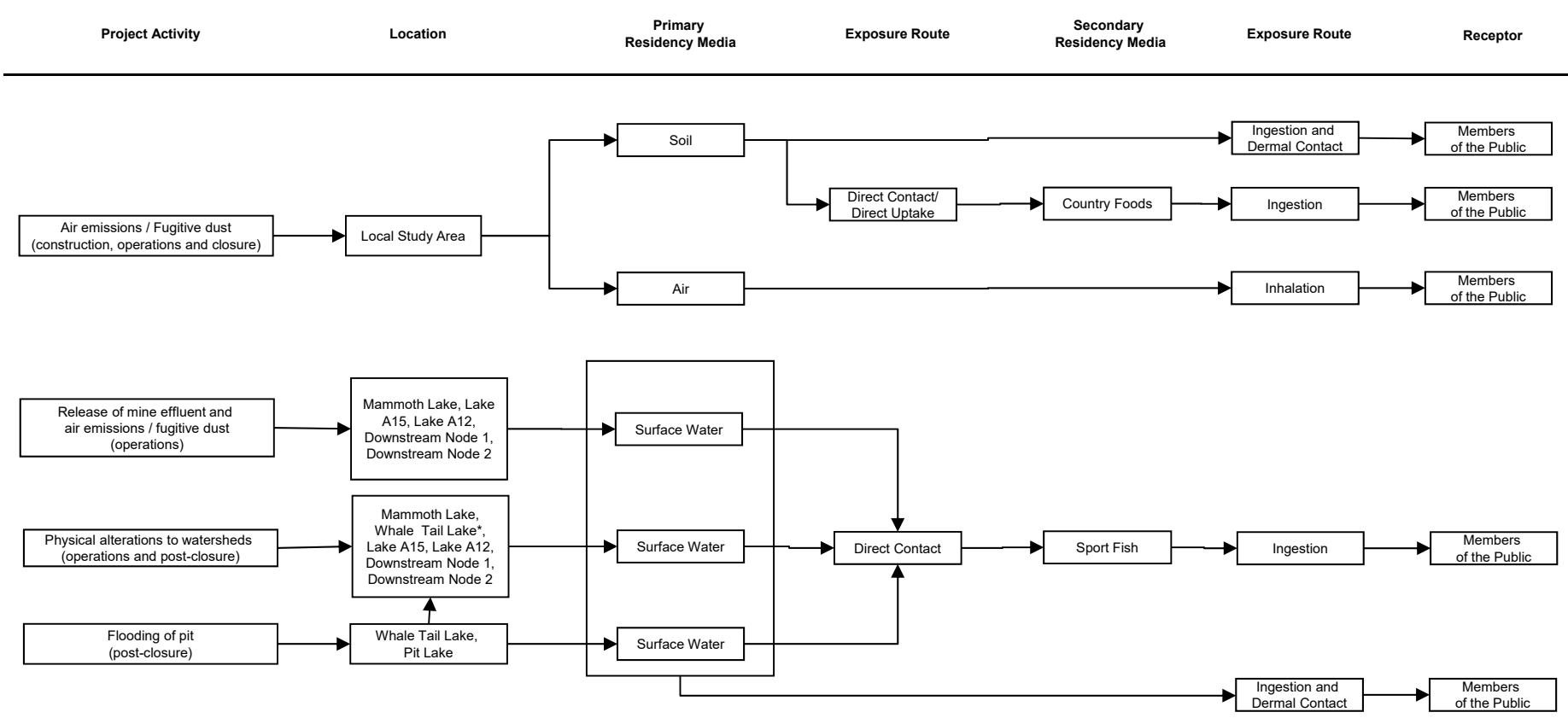
A conceptual site model (CSM; Figure 3.1-1) was developed for human health based upon the primary pathways identified above (Table 1.3-1). The exposure pathways between Project activities, intermediate residency media (i.e., the aspects of the environment that that may experience a change in quality due to Project activities/emissions), and receptors are shown to be either complete or incomplete. Where pathways are incomplete, quantitative assessment was not carried out given that environmental quality was not anticipated to change as a result of the Project. Complete pathways on the figure indicate that a change to environmental quality was predicted and a quantitative assessment of the potential effects to human health was carried out. A brief summary of the complete exposure pathways are provided below for Inuit and non-Inuit members of the public:

- inhalation of air;
- incidental ingestion and dermal contact with soil;
- ingestion and dermal contact with surface water; and
- consumption of country foods (e.g., caribou, fish).

It is noted that lake water would not be used by the camps during operations and at closure as a drinking water source unless it was treated prior to consumption. The assessment carried out in the HHERA considers that lake water could be consumed without prior treatment by members of the public throughout the life of the Project, and considers that untreated water from the flooded pits could be used by members of the public in the post-closure phases.

Conceptual Site Model for the Project – Human Health

FIGURE 3.1-1



LEGEND

- - - ▶ **Pathway incomplete and/or not evaluated**

——▶ **Pathway complete and evaluated**

*** For post-closure phase only**

Date: June 17, 2016	Golder Associates	CAD: AA
Project: 1541520 (3500)		CKD: TMG

3.2 Air Quality

3.2.1 Problem Formulation

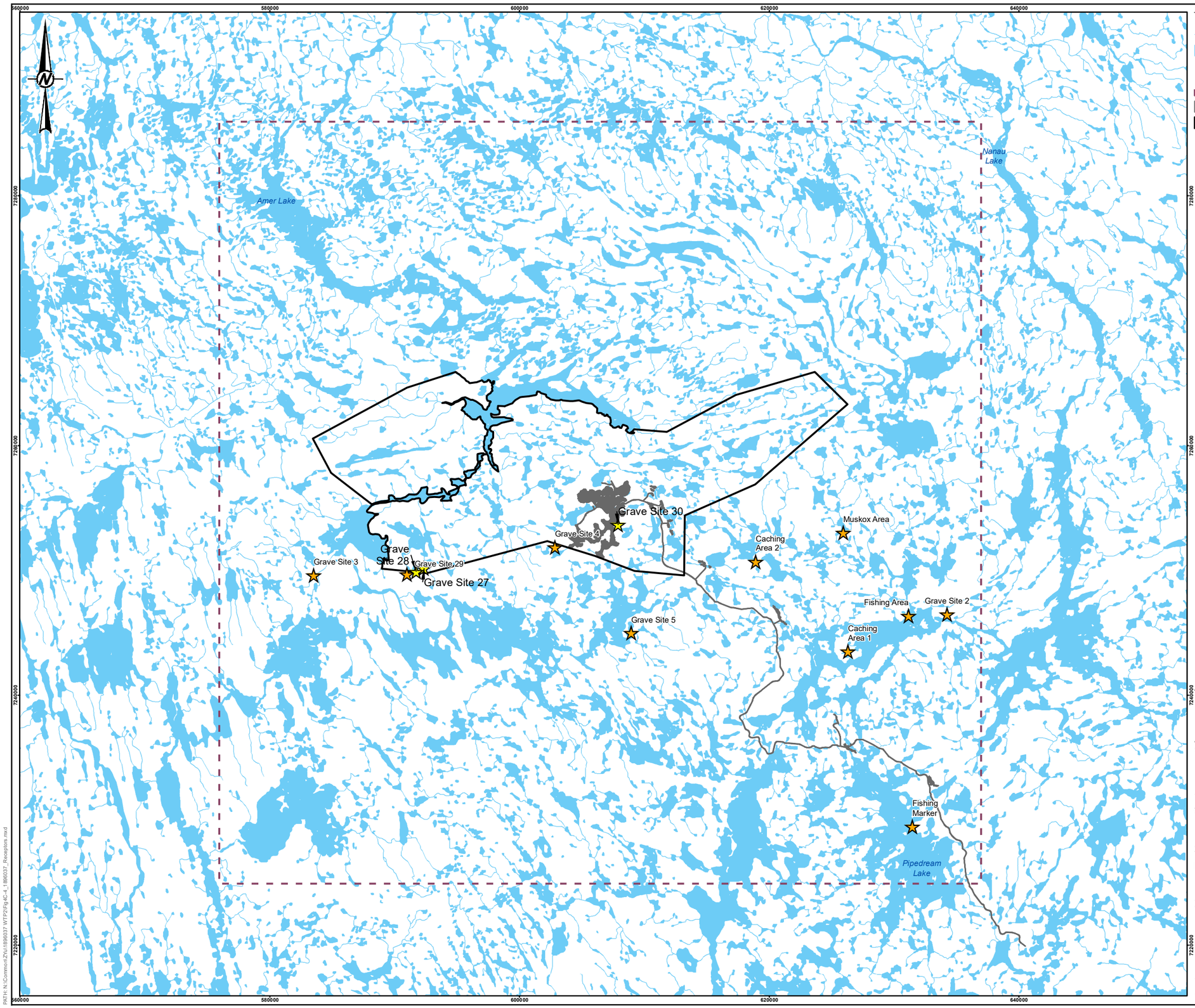
Problem formulation consists of identification of receptors, pathways, and chemicals of potential concern (COPCs).

Effects on human health were evaluated based on the traditional use of the area. Locations that were identified as part of the IQ Baseline Study (Agnico Eagle 2014) were identified as human receptor locations for the purposes of predicting changes to air quality. No additional human receptor locations were identified in community consultation notes from Agnico Eagle (2018a,c), NIRB and NWB (2017), and NIRB (2017). Sixteen receptor locations were identified (Table 3.2-1; Figure 3.1-2). Please note that several of these locations are within the Project boundary (marked with an asterisk [*] in Table 3.2-1), and therefore there would be no access to these locations by members of the public during the construction, operations, and closure phases of the Project.

Table 3.2-1: Human Health Receptor Location Descriptions for Air Quality

Receptor Name	Description
Grave Site 2	Grave site near Nutipilik Lake, southeast of Whale Tail Pit
Grave Site 3	Grave site west of Whale Tail Pit
Grave Site 4	Grave site west of Whale Tail Pit
Grave Site 5	Grave site south of Whale Tail Pit
Grave Site 27*	Grave site west of Whale Tail Pit
Grave Site 28*	Grave site west of Whale Tail Pit
Grave Site 29*	Grave site west of Whale Tail Pit
Grave Site 30*	Grave site within secondary disturbance area of Whale Tail Pit
Fishing Marker	Fishing area on Pipedream Lake, southeast of Whale Tail Pit, near proposed haul road to Meadowbank Mine
Muskox	Muskox hunting area, east of Whale Tail Pit
Muskox 2*	Muskox hunting area, south of Whale Tail Pit
To Iglu*	Location along winter travel route to Iglujaalik (Garry Lake), Chantrey Inlet, Gjoa Haven, Hanninajuaq (Middle Back River), northeast of Whale Tail Pit
Fishing Area	Fishing area on Nutipilik Lake, identified camping area, southeast of Whale Tail Pit
Caching Area	Caching area near Nutipilik Lake, southeast of Whale Tail Pit
Track*	Tracking area (foxes and wolves), east of Whale Tail Pit
Caching	Caching area near Tahinajuk Lake, east of Whale Tail Pit

Note: The receptor locations marked with an asterisk (*) indicate locations that are within of the Project boundary and therefore there is no access for members of the public during the construction, operations, and closure phases of the Project. Therefore, all other locations are locations that can be accessed by members of the public during all phases of the Project.



LEGEND

- WATERCOURSE
- WATERBODY
- DISCRETE RECEPTOR
- MODEL BOUNDARY
- PROJECT FOOTPRINT - EXPANSION PROJECT
- PROPERTY BOUNDARY
- HHERA RECEPTORS

0 5,000 10,000

1:302,984 METRES

REFERENCE(S)

1. NATIONAL TOPOGRAPHIC DATA BASE (NTDB) DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 14 DATUM: NAD 83

CLIENT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION

PROJECT

WHALE TAIL PIT - EXPANSION PROJECT

TITLE

Human Health Receptor Locations for Air Quality

CONSULTANT

GOLDER

YYYY-MM-DD	2019-04-17
DESIGNED	ZY
PREPARED	LMS
REVIEWED	
APPROVED	

PROJECT NO.	PHASE	REV.	FIGURE
19115196	2300	0	**3.1-2**

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0 25mm

PATH: N:\Common\ZV\u19\19115196037 WTP2\Fig4C-4_19115196037_Receptors.mxd

Predicted concentrations for chemicals in air (i.e., criteria air contaminants and metals) were compared to the health-based thresholds for the relevant averaging period (i.e., 1-hour, 24-hour and annual) from Government of Nunavut Department of Environment (NDOE 2011). If a threshold was not available from NDOE, the most conservative (i.e., protective) of the available health-based thresholds was selected from the following agencies:

- CCME (CCME 1999a);
- Ontario Ministry of the Environment, Conservation and Parks (MECP 2018);
- Agency for Toxic Substances and Disease Registry (ATSDR 2018);
- California Environmental Protection Agency (CalEPA 2016);
- World Health Organization (WHO 2000, 2005); and
- Texas Commission on Environmental Quality (TCEQ 2018).

Additionally, comparison to baseline concentrations (where available) plus 10% was completed. If predicted concentrations for chemicals in air were greater than the available health-based thresholds and baseline concentrations plus 10% (where available), the chemical was identified as a COPC (Attachment 3-B-1).

Based upon the screening process outlined above, the following COPCs (Table 3.2-2) were identified:

Table 3.2-2: Chemicals of Potential Concern for Air Quality

Averaging Period	Chemical	Location	Approved Project – Maximum Concentration plus Background (µg/m^3)	Expansion Project – Maximum Concentration plus Background (µg/m^3)
1-hour	NO_2	Grave Site 30	--	452
24-hour	Arsenic	Grave Site 30	0.0175	0.0193
24-hour	Iron	Grave Site 4	5.68	5.26
24-hour	Iron	Grave Site 30	12.0	13.2
24-hour	Iron	Muskox 2	4.63	4.46
24-hour	Manganese	Grave Site 30	0.124	0.137
Annual	$PM_{2.5}$	Grave Site 30	8.87	10.3

µg/m^3 = micrograms per cubic metre; -- = an exceedance was not identified for the Approved Project.

All locations shown in Table 3.2-2 are within the Project footprint. It is noted that NO_2 was not identified as a COPC for the Approved Project given that its predicted concentration plus background was 177 µg/m^3, which was less than its health-based threshold of 400 µg/m^3. No locations outside the Project footprint exceeded their respective air quality screening values.

3.2.2 Toxicity Assessment

The toxicity assessment involves the determination of the dose to which a receptor can be exposed without experiencing adverse health effects (i.e., dose-response analysis); this dose is called the toxicity reference value

(TRV). Toxicity reference values for the inhalation pathway (i.e., reference concentrations or RfCs) were compiled from the following agencies:

- Ontario Ministry of the Environment, Conservation and Parks (MECP 2018);
- Health Canada (Health Canada 2012);
- United States Environmental Protection Agency's (U.S. EPA's) Integrated Risk Information System (IRIS) (U.S. EPA 2018a);
- CalEPA (CalEPA 2016);
- ATSDR (ATSDR 2018);
- WHO (WHO 2000, 2005); and
- Netherlands National Institute of Public Health and the Environment (RIVM 2001).

The most protective of the available RfCs were selected for use in the assessment (Table 3.2-3).

Table 3.2-3: Selected Toxicity Reference Values for Chemicals of Potential Concern Evaluated in the Air Quality Assessment

COPC	Selected RfC (mg/m^3)	Endpoint	Source
Arsenic	0.00003	Neurobehavioural development in children	CalEPA 2016
Iron	0.004	Health	MECP 2018
Manganese	0.00005	Impairment of neurobehavioural function in workers	U.S. EPA 2018a

COPC = chemical of potential concern; RfC = reference concentration; mg/m^3 = milligrams per cubic metre.

There are no TRVs for $PM_{2.5}$ or NO_2, therefore the selected annual screening threshold (8.8 µg/m^3) and 1-hour screening threshold (400 µg/m^3), respectively, were adopted as the TRVs for the assessment of the predicted concentrations.

3.2.3 Exposure Assessment

Exposure assessment was completed considering the predicted 24-hour and annual concentrations and the amount of time members of the public could spend at the receptor locations with identified COPCs (Table 3.2-4). No further adjustment for exposure was made for the assessment of predicted 1-hour concentrations.

Table 3.2-4: Exposure Assumptions for Air Quality

Exposure Parameter	Grave Sites 4 and 30	Muskox 2
Exposure time	1.5 hours per day	24 hours per day
Exposure frequency	10 days per year	14 days per year
Rationale	Assumed people stop to visit a grave site each time they pass through the area, assuming five round-trips to Back River each year	Assumed a two-week hunting trip or up to seven weekend trips

Considering the assumptions described above (Table 3.2-4) and the approach to calculating inhalation exposure described by Health Canada (2010), exposure doses were calculated for each location and COPC (Table 3.2-5).

Table 3.2-5: Exposure Assessment for Air Quality

Averaging Period	Chemical	Location	Approved Project – Exposure Dose (µg/m^3)	Expansion Project – Exposure Dose (µg/m^3)
1-hour	NO_2	Grave Site 30	--	4.5E+02
24-hour	Arsenic	Grave Site 30	3.0E-07	3.3E-08
24-hour	Iron	Grave Site 4	9.7E-06	9.0E-06
24-hour	Iron	Grave Site 30	2.1E-05	2.3E-05
24-hour	Iron	Muskox 2	1.8E-04	1.7E-04
24-hour	Manganese	Grave Site 30	2.1E-07	2.4E-07
Annual	$PM_{2.5}$	Grave Site 30	1.5E-05	1.8E-05

µg/m^3 = micrograms per cubic metre; -- = not identified as a COPC for the Approved Project.

3.2.4 Risk Characterization

Using the approach described by Health Canada (2010) to calculate hazard quotients (HQs) for air contaminants and using a target HQ of 0.2 (a target HQ of 1 is used for the 1-hour averaging period), HQs were calculated for each location and COPC (Table 3.2-6).

Table 3.2-6: Risk Characterization for Air Quality

Averaging Period	COPC	Location	Approved Project – Hazard Quotient	Expansion Project – Hazard Quotient
1-hour	NO_2	Grave Site 30	--	**1.1**
24-hour	Arsenic	Grave Site 30	0.001	0.001
24-hour	Iron	Grave Site 4	0.002	0.002
24-hour	Iron	Grave Site 30	0.005	0.006
24-hour	Iron	Muskox 2	0.04	0.04
24-hour	Manganese	Grave Site 30	0.004	0.005
Annual	$PM_{2.5}$	Grave Site 30	0.002	0.002

Shaded and bold text = hazard quotient > 1; COPC = chemical of potential concern; -- = not identified as a COPC for the Approved Project.

All HQs for the 24-hour and annual averaging periods were less than the target HQ of 0.2; therefore, health risks due to members of the public are considered to be negligible for these COPCs. However, at Grave Site 30, the predicted 1-hour maximum concentration of NO_2 resulted in an HQ of 1.1, which is slightly greater than its target HQ of 1. However, given that this location is within the Project boundary and access to members of the public would be restricted, NO_2 was not retained as for further evaluation in the residual effects classification given that exposure to members of the public is not expected to occur.

3.3 Soil Quality

3.3.1 Problem Formulation

Changes to soil quality as a result of the Approved and Expansion Project were predicted using wet and dry particulate deposition rates for the non-volatile parameters (i.e., metals) predicted to be present in emissions. In brief, particulate deposition rates were predicted as part of the air quality modeling and methods described in the Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (U.S. EPA 2005a) were used to predict incremental changes to soil quality. The incremental changes to soil quality were then added to the measured baseline soil quality data as described in Section 2.0 to predict the changes to soil quality as a result of the Approved and Expansion Project.

Predicted concentrations of chemicals in soil were screened against the CCME Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (CCME 1999b) for residential land use and the U.S. EPA Regional Screening Levels (U.S. EPA 2018b) for residential soils. If predicted concentrations for chemicals in soil were greater than the screening values and maximum baseline concentrations plus 10%, the chemical was identified as a COPC.

All concentrations in soil met their respective screening values and/or baseline plus 10% (Attachment 3-B-2) with the exception of sodium for the Expansion Project, which was greater than its baseline concentration +10% (no screening values are available for sodium). Sodium is naturally occurring and is present in the earth's crust at a concentration of 2.83% by weight (HSDB 2007); as a result, sodium was not retained as a COPC and therefore no COPCs were retained in soil and no residual impacts due to changes to soil quality were identified.

Previous risk assessments completed at the Meadowbank Mine in 2006 and 2014 (Wilson Scientific Consulting Inc. 2006; Azimuth Consulting Group Inc. 2006; Agnico Eagle 2012; Agnico Eagle 2015a; Agnico Eagle 2015b) concluded that no significant changes to soil quality, and subsequent changes to vegetation and country food quality, would be expected due to the atmospheric emissions from the Meadowbank Mine (i.e., risks would be negligible). Therefore, given that Project emissions are expected to be lower than those from the Meadowbank Mine, potential changes to soil quality (and vegetation and country food quality) and risks to human health and wildlife would be similarly negligible. These conclusions support the effects assessments for human health with respect to atmospheric pathways to soils and country foods.

3.4 Country Foods Quality

Given that no COPCs were identified in soil (Section 3.3), concentrations of chemicals in country foods (i.e., plants and animals consumed by people) were not anticipated to change in country foods. As a result, country foods were not assessed further with respect to potential human health effects and no residual impacts due to changes to country food quality were identified.

3.5 Water Quality

3.5.1 Problem Formulation

Effects on human health were evaluated based on the traditional use of the area and the waterbodies expected to be affected by discharges from the Approved Project including the two alternatives assessed in the Expansion Project. Locations that were identified by the water quality effects assessment (Volume 6, Section 6.2; Agnico Eagle 2018b) were assessed in the HHERA, with the exceptions of the Whale Tail Waste Rock Storage Facility and Whale

Tail Attenuation Pond, which were not considered to be aquatic habitat nor used by people for traditional or non-traditional purposes. Seven receiving waterbodies were identified (Table 3.5-1.

Table 3.5-1: Human Health Receptor Location Descriptions for Water Quality

Receptor Name	Description	Project Phase(s)
Mammoth Lake	Lake located downstream from Whale Tail Lake	Operations, Closure (pit flooding, maintenance) and Post-Closure
Lake A15	Lake located downstream from Mammoth Lake	Operations, Closure (pit flooding, maintenance) and Post-Closure
Lake A12	Lake located downstream from Lake A15	Operations, Closure (pit flooding, maintenance) and Post-Closure
Lake A76	Lake located downstream from Lake A12	Operations, Closure (pit flooding, maintenance) and Post-Closure
Downstream Node 1	Stream located at the end of downstream path 1 (west and north direction)	Operations, Post-Closure
Downstream Node 2	Stream located at the end of downstream path 2 (east and north direction)	Operations, Post-Closure
Whale Tail Lake (North Basin)	Northern portion of Whale Tail Lake (Approved Project only)	Post-Closure
Whale Tail Lake (South Basin)	Southern portion of Whale Tail Lake (Expansion Project only)	Post-Closure
Flooded Pit	The open pit that will be allowed to flood once the mine is closed	Closure
IVR Pit	Secondary pit that will be allowed to flood once the mine is closed	Closure
Lake D1 or D5	Mitigation option being considered is discharge of treated effluent to Lake D1 or Lake D5 in the D watershed	

Predicted total concentrations for chemicals in water (i.e., metals) were compared to relevant health-based guidelines to identify COPCs. This initial screening step was reported in Volume 6, Section 6.4, and included comparison to the Canadian Drinking Water Quality Guidelines from Health Canada (Health Canada 2014), as well as the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999b) for the purposes of assessing potential effects to aquatic life (Section 5.0). Additionally, comparison to maximum baseline concentrations (where available) plus 10% was completed as part of the screening step (Attachment 3-B-3). If predicted concentrations for chemicals in water were greater than screening values and baseline concentrations plus 10%, the chemical was identified as a COPC.

Predictions were provided for several water quality parameters (e.g., acidity), nutrients (e.g., total ammonia, phosphorus), and inorganics (e.g., calcium) for which health-based guidelines are not available nor have been developed. These parameters and substances are not considered to be directly toxic to human health and were therefore not considered in the water quality screening.

Some parameters did not have screening values; if predicted concentrations were within 10% of maximum baseline concentrations, these parameters were not retained for further assessment. Otherwise, if the parameter could be associated with health effects or it is uncertain, a second tier of screening was completed as part of the HHERA. For substances without guidelines, the U.S. EPA Regional Screening Levels for tap water adjusted to a target HQ of 0.2 were used for comparison purposes (U.S. EPA 2018b).

Based upon the screening process outlined above, the following COPCs are identified in Table 3.5-2. Note that the concentrations for closure (maintenance) is equivalent to post-closure (Year 1) for the Approved Project, and that post-closure is equivalent to long-term for the Approved Project.

Table 3.5-2: Chemicals of Potential Concern for Water Quality

Chemical	Location(s)	Project Phase(s)	Approved Project – Concentration (µg/L)	Expansion Project – Concentration (µg/L)	Guideline (µg/L)
Arsenic	Mammoth Lake	Operations	18	19	10 (MAC)
		Closure (pit flooding)	20	17	
		Closure (maintenance)	--	25	
		Post-Closure	--	21	
	Lake A15	Operations	16	14	
		Closure (pit flooding)	17	13	
		Closure (maintenance)	--	21	
		Post-Closure	--	18	
	Lake A12	Operations	15	13	
		Closure (pit flooding)	15	12	
		Closure (maintenance)	--	20	
		Post-Closure	--	17	
	Lake A76	Closure (maintenance)	--	17	
		Post-Closure	--	16	
	DS Node 2	Closure (maintenance)	--	11	
		Post-Closure	--	11	
	Whale Tail Lake South Basin	Operations	--	26	
		Closure (pit flooding)	--	26	
	Whale Tail Pit	Closure (maintenance)	--	30	
		Post-Closure	--	22	
	IVR Pit	Closure (maintenance)	--	13	
		Post-Closure	--	12	

Chemical	Location(s)	Project Phase(s)	Approved Project – Concentration (µg/L)	Expansion Project – Concentration (µg/L)	Guideline (µg/L)
Manganese	Mammoth Lake	Operations	74	132	50 (AO)
		Closure (pit flooding)	121	85	
		Closure (maintenance)	--	89	
		Post-Closure	--	70	
	Lake A15	Operations	65	101	
		Closure (pit flooding)	96	67	
		Closure (maintenance)	53	76	
		Post-Closure	--	60	
	Lake A12	Operations	61	89	
		Closure (pit flooding)	85	63	
		Closure (maintenance)	54	74	
		Post-Closure	--	58	
	Lake A76	Operations	--	58	
		Closure (maintenance)	--	62	
		Post-Closure	--	53	
	Whale Tail Lake South Basin	Operations	--	131	
		Closure (pit flooding)	--	131	
	Whale Tail Pit	Closure (maintenance)	51	109	
		Post-Closure	51	74	

µg/L = microgram per litre; AO = Aesthetic Objective (Health Canada 2017); MAC = Maximum Acceptable Concentration (Health Canada 2017); -- = not identified as a COPC for the Approved Project.

Although the concentration of aluminum was greater than its Health Canada drinking water quality guideline for the Approved Project, it did not exceed its screening value for the Expansion Project. Additionally, the value for aluminum is based upon an operational guideline for water treatment. However, a health-based guideline of 4,000 µg/L is available from the U.S. EPA (2018b). As a result, aluminum was not retained as a COPC for the human health effects assessment.

No guidelines are available for bismuth, but concentrations of this substance greater than baseline + 10% were predicted for all waterbodies with the exception of Mammoth Lake for the operations, closure, and post-closure phases of the Project. Bismuth is most commonly used an ingredient in over-the-counter preparations for gastrointestinal distress (e.g., Pepto-Bismol®). A probable lethal dose of between 0.5 and 5 grams per kilogram body weight has been identified (Gosselin et al. 1976; as summarized in HSDB 2002). Bismuth was identified at a maximum concentration of 0.033 µg/L. At this concentration, assuming an adult consumes 1.5 L/day (Health

Canada 2010), the total daily dose would be 1E-09 grams per kilogram body weight, which is orders of magnitude less than the probable lethal dose. Therefore, bismuth was not considered further as a COPC.

3.5.2 Toxicity Assessment

Toxicity reference values (termed reference doses or RfDs for non-carcinogenic substances and slope factors or SFs for carcinogenic substances) were compiled from the following agencies:

- Health Canada (Health Canada 2012);
- U.S. EPA's IRIS (U.S. EPA 2018a);
- CalEPA (CalEPA 2016);
- Agency for Toxic Substances and Disease Registry (ATSDR 2018); and
- Netherlands National Institute of Public Health and the Environment (RIVM 2001; 2009).

The most protective of the available TRVs were selected for use in the assessment (Table 3.5-3).

Table 3.5-3: Selected Toxicity Reference Values for Chemicals of Potential Concern Evaluated in the Water Quality Assessment

COPC	Selected TRV	Endpoint	Source
Arsenic	RfD: 0.0003 mg/kg-d SF: 1.8 $(mg/kg\text{-}d)^{-1}$	RfD: Skin lesions RfD: Skin cancer	U.S. EPA 2018a Health Canada 2012
Manganese	RfD (adult): 0.156 mg/kg-d	Parkinsonian-like neurotoxicity	Health Canada 2012

COPC = chemical of potential concern; mg/kg-d = milligram per kilogram body weight per day; $(mg/kg\text{-}d)^{-1}$ = cancer incidence per milligram per kilogram body weight per day; RfD = oral reference dose; SF = oral slope factor; TRV = toxicity reference value.

3.5.3 Exposure Assessment

The exposure assessment was completed considering the amount of time members of the public could rely on surface water as a potable water source at the locations with identified COPCs (Table 3.5-4).

Table 3.5-4: Exposure Assumptions for Water Quality

Exposure Parameter	Potable Water Scenario	Rationale/Source
Water consumption rate	1.5 litres per day	Health Canada 2010
Exposure frequency	14 days per year	Assume a two-week hunting trip each year throughout the life of the Project
Exposure duration	Phase-dependent: <u>Approved Project:</u> Construction/Operation – 5 years Closure – 2 years Post-Closure (early) – 10 years Post-Closure (late) – 43 years <u>Expansion Project:</u> Construction/Operation – 5 years Closure (pit flooding) – 15 years Closure (maintenance) – 9 years Post-Closure – 31 years	No predictions were available for the Construction Phase, therefore predictions for Operations were conservatively adopted for Construction. Long-term predictions were assumed to represent the remainder of the adult life stage (total adult life stage = 60 years)

Considering the assumptions described above (Table 3.5-4) and the approach to calculating water consumption exposure described by Health Canada (2010), exposure doses were calculated for each location and COPC (Table 3.5-5). Exposure doses were calculated for adults given this is the age group most likely to be on extended hunting trips in the area, during which they may rely on nearby lakes for their potable water.

Table 3.5-5: Exposure Assessment for Water Quality

COPC	Location(s)	Project Phase(s)	Approved Project - Exposure Dose (mg/kg-d)	Expansion Project - Exposure Dose (mg/kg-d)
Non-cancer Endpoints				
Arsenic	Mammoth Lake	Operations	1.5E-05	1.5E-05
		Closure (pit flooding)	1.6E-05	1.4E-05
		Closure (maintenance)	--	2.0E-05
		Post-Closure	--	1.7E-05
	Lake A15	Operations	1.3E-05	1.1E-05
		Closure (pit flooding)	1.4E-05	1.1E-05
		Closure (maintenance)	--	1.7E-05
		Post-Closure	--	1.5E-05
	Lake A12	Operations	1.2E-05	1.1E-05
		Closure (pit flooding)	1.2E-05	9.8E-06
		Closure (maintenance)	--	1.6E-05
		Post-Closure	--	1.4E-05
	Lake A76	Closure (maintenance)	--	1.4E-05
		Post-Closure	--	1.3E-05
	DS Node 2	Closure (maintenance)	--	9.0E-06
		Post-Closure	--	9.0E-06
	Whale Tail Lake South Basin	Operations	--	2.1E-05
		Closure (pit flooding)	--	2.1E-05
	Whale Tail Pit	Closure (maintenance)	--	2.4E-05
		Post-Closure	--	1.8E-05
	IVR Pit	Closure (maintenance)	--	1.1E-05
		Post-Closure	--	9.8E-06
Manganese	Mammoth Lake	Operations	6.0E-05	1.1E-04

COPC	Location(s)	Project Phase(s)	Approved Project - Exposure Dose (mg/kg-d)	Expansion Project - Exposure Dose (mg/kg-d)
		Closure (pit flooding)	9.8E-05	6.9E-05
		Closure (maintenance)	--	7.2E-05
		Post-Closure	--	5.7E-05
	Lake A15	Operations	5.3E-05	8.2E-05
		Closure (pit flooding)	7.8E-05	5.5E-05
		Closure (maintenance)	--	6.2E-05
		Post-Closure	--	4.9E-05
	Lake A12	Operations	--	7.2E-05
		Closure (pit flooding)	--	5.1E-05
		Closure (maintenance)	--	6.0E-05
		Post-Closure	--	4.7E-05
	Lake A76	Operations	--	4.7E-05
		Closure (maintenance)	--	5.0E-05
		Post-Closure	--	4.3E-05
	Whale Tail Lake South Basin	Operations	--	1.1E-04
		Closure (pit flooding)	--	1.1E-04
	Whale Tail Pit	Closure (maintenance)	--	8.9E-05
		Post-Closure	--	6.0E-05
Cancer Endpoints[(a)]				
Arsenic	Mammoth Lake	Operations	9.2E-07	9.7E-07
		Closure (pit flooding)	4.1E-07	2.6E-06
		Closure (maintenance)	8.6E-07	2.3E-06
		Post-Closure	1.2E-06	6.6E-06
	Lake A15	Operations	8.1E-07	7.1E-07
		Closure (pit flooding)	3.5E-07	2.0E-06
		Closure (maintenance)	8.4E-07	1.9E-06
		Post-Closure	1.1E-06	5.7E-06
	Lake A12	Operations	7.6E-07	6.6E-07

COPC	Location(s)	Project Phase(s)	Approved Project - Exposure Dose (mg/kg-d)	Expansion Project - Exposure Dose (mg/kg-d)
		Closure (pit flooding)	3.1E-07	1.8E-06
		Closure (maintenance)	8.2E-07	1.8E-06
		Post-Closure	1.0E-06	5.0E-06
	Lake A76	Operations	--	4.6E-07
		Closure (pit flooding)	--	1.4E-06
		Closure (maintenance)	--	1.6E-06
		Post-Closure	--	5.0E-06
	DS Node 2	Operations	--	3.6E-07
		Closure (pit flooding)	--	7.6E-07
		Closure (maintenance)	--	1.0E-06
		Post-Closure	--	3.5E-06
	Whale Tail Lake South Basin	Operations	--	1.3E-06
		Closure (pit flooding)	--	4.0E-06
		Closure (maintenance)	--	1.5E-08
		Post-Closure	--	5.0E-08
	Whale Tail Pit	Closure (maintenance)	--	2.7E-06
		Post-Closure	--	6.9E-06
	IVR Pit	Closure (maintenance)	--	1.2E-06
		Post-Closure	--	3.5E-06

-- = not retained as a COPC; COPC = chemical of potential concern; mg/kg-d = milligrams per kilogram body weight per day.

(a) Note that cancer exposure for all project phases was evaluated, even if arsenic did not exceed its benchmark for that phase given that carcinogenic risks are additive over the life of the Project.

3.5.4 Risk Characterization

Using the approach described by Health Canada (2010) to calculate health risks for contaminated water and using a target HQ of 0.2 and target incremental lifetime cancer risk (ILCR) of 3E-05 (or 1 in 100,000), HQs and ILCRs were calculated for each location and COPC (Table 3.5-6). It is noted that an alternate target ILCR was used for the drinking water pathway to be consistent with the estimated cancer risk levels associated with arsenic exposure at the Canadian Guideline for Drinking Water Quality (CGDWQ; Health Canada 2006) for arsenic which ranges from 3 to 39 in 100,000 at the MAC of 10 µg/L and 8 to 97 in 100,000 at a concentration of 25 µg/L (consistent with the SSWQO). Therefore, it was considered reasonable to adopt a target ILCR that is consistent with the MAC to ensure that risks due to the Project do not exceed those considered acceptable for the Canadian population.

Table 3.5-6: Risk Characterization for Water Quality

COPC	Location(s)	Project Phase(s)	Approved Project – Estimated Risks	Expansion Project - Estimated Risks
Non-cancer Endpoints – Hazard Quotients				
Arsenic	Mammoth Lake	Operations	0.05	0.05
		Closure (pit flooding)	0.05	0.05
		Closure (maintenance)	--	0.07
		Post-Closure	--	0.06
	Lake A15	Operations	0.04	0.04
		Closure (pit flooding)	0.05	0.04
		Closure (maintenance)	--	0.06
		Post-Closure	--	0.05
	Lake A12	Operations	0.04	0.04
		Closure (pit flooding)	0.04	0.03
		Closure (maintenance)	--	0.05
		Post-Closure	--	0.05
	Lake A76	Closure (maintenance)	--	0.05
		Post-Closure	--	0.04
	DS Node 2	Closure (maintenance)	--	0.03
		Post-Closure	--	0.03
	Whale Tail Lake South Basin	Operations	--	0.07
		Closure (pit flooding)	--	0.07
	Whale Tail Pit	Closure (maintenance)	--	0.08
		Post-Closure	--	0.06
	IVR Pit	Closure (maintenance)	--	0.04
		Post-Closure	--	0.03
Manganese	Mammoth Lake	Operations	0.0004	0.0007
		Closure (pit flooding)	0.0006	0.0004
		Closure (maintenance)	--	0.0005
		Post-Closure	--	0.0004
	Lake A15	Operations	0.0003	0.0005

COPC	Location(s)	Project Phase(s)	Approved Project – Estimated Risks	Expansion Project - Estimated Risks
		Closure (pit flooding)	0.0005	0.0003
		Closure (maintenance)	--	0.0004
		Post-Closure	--	0.0003
	Lake A12	Operations	--	0.0005
		Closure (pit flooding)	--	0.0003
		Closure (maintenance)	--	0.0004
		Post-Closure	--	0.0003
	Lake A76	Operations	--	0.0003
		Closure (maintenance)	--	0.0003
		Post-Closure	--	0.0003
	Whale Tail Lake South Basin	Operations	--	0.0007
		Closure (pit flooding)	--	0.0007
	Whale Tail Pit	Closure (maintenance)	--	0.0006
		Post-Closure	--	0.0004
Cancer Endpoints[a] – Incremental Lifetime Cancer Risks				
Arsenic	Mammoth Lake	Operations	1.6E-06	1.7E-06
		Closure (pit flooding)	7.3E-07	4.7E-06
		Closure (maintenance)	1.6E-06	4.1E-06
		Post-Closure	2.2E-06	3.5E-06
		Total ILCR	7E-06	2E-05
	Lake A15	Operations	1.5E-06	1.3E-06
		Closure (pit flooding)	6.2E-07	3.6E-06
		Closure (maintenance)	1.5E-06	3.5E-06
		Post-Closure	2.0E-06	1.0E-05
		Total ILCR	6E-06	2E-05
	Lake A12	Operations	1.4E-06	1.2E-06
		Closure (pit flooding)	5.5E-07	3.3E-06
		Closure (maintenance)	1.5E-06	3.3E-06

COPC	Location(s)	Project Phase(s)	Approved Project – Estimated Risks	Expansion Project - Estimated Risks
		Post-Closure	1.9E-06	9.6E-06
		Total ILCR	6E-06	2E-05
	Lake A76	Operations	--	8.3E-07
		Closure (pit flooding)	--	2.5E-06
		Closure (maintenance)	--	2.8E-06
		Post-Closure	--	9.1E-06
		Total ILCR	--	2E-05
	DS Node 2	Operations	--	6.4E-07
		Closure (pit flooding)	--	1.4E-06
		Closure (maintenance)	--	1.8E-06
		Post-Closure	--	6.2E-06
		Total ILCR	--	1E-05
	Whale Tail Lake South Basin	Operations	--	2.4E-06
		Closure (pit flooding)	--	7.1E-06
		Closure (maintenance)	--	2.6E-08
		Post-Closure	--	9.1E-08
		Total ILCR	--	1E-05
	Whale Tail Pit	Closure (maintenance)	--	4.9E-06
		Post-Closure	--	1.2E-05
		Total ILCR	--	2E-05
	IVR Pit	Closure (maintenance)	--	2.1E-06
		Post-Closure	--	6.8E-06
		Total ILCR	--	9E-06

Shaded and bold text = HQ > 0.2 or ILCR > 3E-05; -- = not retained as a COPC; COPC = chemical of potential concern; ILCR = incremental lifetime cancer risk.

(a) Note that cancer exposure for all project phases was evaluated, even if arsenic did not exceed its benchmark for that phase given that carcinogenic risks are additive over the life of the Project.

All calculated HQs were less than their target of 0.2, and all calculated ILCRs for arsenic were less than their target of $3x10^{-5}$. Therefore, non-carcinogenic and carcinogenic health risks are not expected for members of the public that may rely on any of the assessed waterbodies as their potable water supply should these receptors spend time

in the area. As a result, water quality was not assessed further with respect to potential human health effects and no residual impacts due to changes to water quality were identified.

3.6 Fish Tissue Quality

3.6.1 Problem Formulation

Given that there were predicted changes to water quality (i.e., arsenic and manganese), changes to fish tissue quality of these COPCs may also be possible.

3.6.2 Toxicity Assessment

The same TRVs for arsenic and manganese used for water quality (Section 5.2) were used to assess potential risks due to changes in fish tissue quality.

3.6.3 Exposure Assessment

Changes to fish tissue quality for the Approved Project were predicted for the COPCs that were predicted to change in water (i.e., arsenic and manganese) using site-specific water-to-fish bioconcentration factors (BCFs) calculated for the Approved Project derived from the average baseline water and fish tissue concentrations (Table 3.6-1).

Table 3.6-1: Site-Specific Water-to-Fish Bioconcentration Factors

COPC	Average Baseline Fish Tissue Concentration (mg/kg wet weight)	Average Baseline Water Quality Concentration (mg/L)	Site-Specific Water-to-Fish Bioconcentration Factor (L/kg)
Arsenic	0.0322	0.00026	124
Manganese	0.139	0.00307	45

COPC = chemical of potential concern; mg/kg = milligram per kilogram; mg/L = milligrams per litre; L/kg = litres per kilogram

Using these site-specific BCFs, changes to fish tissue quality for each lake and phase of the Approved Project were predicted (Table 3.6-2).

Table 3.6-2: Predicted Fish Tissue Concentrations for the Approved Project

COPC	Location(s)	Project Phase(s)	Approved Project - Predicted Fish Tissue Concentrations (mg/kg wet weight)
Arsenic	Mammoth Lake	Construction/Operations	2.23
		Closure	2.48
		Post-Closure (early)	1.05
		Post-Closure (late)	0.35
	Lake A15	Construction/Operations	1.98
		Closure	2.11
		Post-Closure (early)	1.03
		Post-Closure (late)	0.32

COPC	Location(s)	Project Phase(s)	Approved Project - Predicted Fish Tissue Concentrations (mg/kg wet weight)
	Lake A12	Construction/Operations	1.86
		Closure	1.86
		Post-Closure (early)	1.00
		Post-Closure (late)	0.30
	Lake A76	Construction/Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	DS Node 2	Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Lake South Basin	Construction/Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--
	IVR Pit	Post-Closure (early)	--
		Post-Closure (late)	--
Manganese	Mammoth Lake	Operations	3.35
		Closure	5.48
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A15	Operations	2.94
		Closure	4.35
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A12	Operations	--
		Closure	--

COPC	Location(s)	Project Phase(s)	Approved Project - Predicted Fish Tissue Concentrations (mg/kg wet weight)
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A76	Operations	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Lake South Basin	Operations	--
		Closure	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--

COPC = chemical of potential concern; mg/kg = milligram per kilogram; -- = not identified as a COPC for the Approved Project

Changes to fish tissue quality for the Expansion Project for arsenic were assessed considering the toxicokinetics of arsenic. Williams et al. (2006) competed a review of 12 laboratory and field studies in which arsenic concentrations in water and fish tissue were measured. The four laboratory studies were used to generate BCFs and the 8 field studies were used to generate bioaccumulation factors (BAFs). Given that no significant differences were identified between the laboratory and field studies, the datasets were combined and used to generate a relationship between water concentration and BCF. Using whole body data from carp, channel catfish, bluegill and rainbow trout, a power function (where y = BCF in L/kg and x = water concentration in µg/L) with a r^2 of 0.86 and level of significance of $p < 0.0001$ was derived: $y = 67.1x^{-0.66}$. This equation was used to determine fish tissue concentrations for each water body and each phase of the Project. Changes to fish tissue quality of manganese were assessed using the site-specific BCF for the Expansion Project. The predicted fish tissue concentrations for the Expansion Project are shown in Table 3.6-3 below.

Table 3.6-3: Predicted Fish Tissue Concentrations for the Expansion Project

COPC	Location(s)	Project Phase(s)	Expansion Project - Predicted Fish Tissue Concentrations (mg/kg wet weight)
Arsenic	Mammoth Lake	Construction/Operations	1.83E-01
		Closure (pit flooding)	1.76E-01
		Closure (maintenance)	2.00E-01
		Post-Closure	1.89E-01
	Lake A15	Construction/Operations	1.65E-01
		Closure (pit flooding)	1.60E-01
		Closure (maintenance)	1.89E-01

COPC	Location(s)	Project Phase(s)	Expansion Project - Predicted Fish Tissue Concentrations (mg/kg wet weight)
		Post-Closure	1.79E-01
	Lake A12	Construction/Operations	1.60E-01
		Closure (pit flooding)	1.56E-01
		Closure (maintenance)	1.86E-01
		Post-Closure	1.76E-01
	Lake A76	Construction/Operations	1.42E-01
		Closure (pit flooding)	1.42E-01
		Closure (maintenance)	1.76E-01
		Post-Closure	1.72E-01
	DS Node 2	Construction/Operations	1.30E-01
		Closure (pit flooding)	1.16E-01
		Closure (maintenance)	1.52E-01
		Post-Closure	1.52E-01
	Whale Tail Lake South Basin	Construction/Operations	2.03E-01
		Closure (pit flooding)	2.03E-01
		Closure (maintenance)	3.60E-02
		Post-Closure	3.60E-02
	Whale Tail Pit	Closure (maintenance)	2.13E-01
		Post-Closure	1.92E-01
	IVR Pit	Closure (maintenance)	1.60E-01
		Post-Closure	1.56E-01
Manganese	Mammoth Lake	Operations	5.98
		Closure (pit flooding)	3.85
		Closure (maintenance)	4.03
		Post-Closure	3.17
	Lake A15	Operations	4.57
		Closure (pit flooding)	3.03
		Closure (maintenance)	3.44

COPC	Location(s)	Project Phase(s)	Expansion Project - Predicted Fish Tissue Concentrations (mg/kg wet weight)
		Post-Closure	2.72
	Lake A12	Operations	4.03
		Closure (pit flooding)	2.85
		Closure (maintenance)	3.35
		Post-Closure	2.63
	Lake A76	Operations	2.63
		Closure (maintenance)	2.81
		Post-Closure	2.40
	Whale Tail Lake South Basin	Operations	5.93
		Closure (pit flooding)	5.93
	Whale Tail Pit	Closure (maintenance)	4.94
		Post-Closure	3.35

Considering the assumptions described above for water quality (Table 3.5-4) and the approach to calculating food consumption exposure described by Health Canada (2010), exposure doses were calculated for each location and COPC (Table 3.6-4 for the Approved Project and Table 3.6-5 for the Expansion Project).

Table 3.6-4: Exposure Assessment for Fish Tissue Quality for Approved Project

COPC	Location(s)	Project Phase(s)	Approved Project - Exposure Dose
Non-cancer Endpoints			(mg/kg-d)
Arsenic	Mammoth Lake	Operations	
		Closure	2.7E-05
		Post-Closure (early)	3.0E-05
		Post-Closure (late)	--
	Lake A15	Operations	--
		Closure	2.4E-05
		Post-Closure (early)	2.5E-02
		Post-Closure (late)	--
	Lake A12	Operations	--
		Closure	2.2E-05
		Post-Closure (early)	2.2E-05
		Post-Closure (late)	--
	Lake A76	Post-Closure (early)	--
		Post-Closure (late)	--
	DS Node 2	Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Lake South Basin	Operations	--
		Closure	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--
	IVR Pit	Post-Closure (early)	--
		Post-Closure (late)	--
Manganese	Mammoth Lake	Operations	--
		Closure	4.0E-04
		Post-Closure (early)	6.5E-04
		Post-Closure (late)	--
	Lake A15	Operations	--

COPC	Location(s)	Project Phase(s)	Approved Project - Exposure Dose
		Closure	3.5E-04
		Post-Closure (early)	5.2E-04
		Post-Closure (late)	--
	Lake A12	Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A76	Operations	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Lake South Basin	Operations	--
		Closure	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--
Cancer Endpoints[a]			
Arsenic	Mammoth Lake	Operations	
		Closure	1.7E-06
		Post-Closure (early)	7.4E-07
		Post-Closure (late)	1.6E-06
	Lake A15	Operations	2.2E-06
		Closure	1.5E-06
		Post-Closure (early)	6.3E-07
		Post-Closure (late)	1.5E-06
	Lake A12	Operations	2.0E-06
		Closure	1.4E-06
		Post-Closure (early)	5.5E-07
		Post-Closure (late)	1.5E-06
	Lake A76	Operations	1.9E-06

COPC	Location(s)	Project Phase(s)	Approved Project - Exposure Dose
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	DS Node 2	Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Lake South Basin	Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--
	IVR Pit	Post-Closure (early)	--
		Post-Closure (late)	--

-- = not retained as a COPC; COPC = chemical of potential concern; mg/kg-d = milligrams per kilogram body weight per day.

(a) Note that cancer exposure for all project phases was evaluated, even if arsenic did not exceed its benchmark for that phase given that carcinogenic risks are additive over the life of the Project.

Table 3.6-5: Exposure Assessment for Fish Tissue Quality for the Expansion Project

COPC	Location(s)	Project Phase(s)	Expansion Project - Exposure Dose (mg/kg-d)
Non-cancer Endpoints			
Arsenic	Mammoth Lake	Operations	2.2E-06
		Closure (pit flooding)	2.7E-06
		Closure (maintenance)	2.4E-06
		Post-Closure	2.9E-06
	Lake A15	Operations	2.0E-06
		Closure (pit flooding)	2.5E-06
		Closure (maintenance)	2.3E-06
		Post-Closure	2.7E-06

COPC	Location(s)	Project Phase(s)	Expansion Project - Exposure Dose (mg/kg-d)
	Lake A12	Operations	1.9E-06
		Closure (pit flooding)	2.4E-06
		Closure (maintenance)	2.2E-06
		Post-Closure	2.6E-06
	Lake A76	Closure (maintenance)	2.1E-06
		Post-Closure	2.5E-06
	DS Node 2	Closure (maintenance)	1.8E-06
		Post-Closure	2.4E-06
	Whale Tail Lake South Basin	Operations	2.4E-06
		Closure (pit flooding)	2.8E-06
	Whale Tail Pit	Closure (maintenance)	2.5E-06
		Post-Closure	2.9E-06
	IVR Pit	Closure (maintenance)	1.9E-06
		Post-Closure	2.4E-06
Manganese	Mammoth Lake	Operations	7.1E-04
		Closure (pit flooding)	4.6E-04
		Closure (maintenance)	4.8E-04
		Post-Closure	3.8E-04
	Lake A15	Operations	5.5E-04
		Closure (pit flooding)	3.6E-04
		Closure (maintenance)	4.1E-04
		Post-Closure	3.2E-04
	Lake A12	Operations	4.8E-04
		Closure (pit flooding)	3.4E-04
		Closure (maintenance)	4.0E-04
		Post-Closure	3.1E-04
	Lake A76	Operations	3.1E-04
		Closure (maintenance)	3.4E-04

COPC	Location(s)	Project Phase(s)	Expansion Project - Exposure Dose (mg/kg-d)
		Post-Closure	2.9E-04
	Whale Tail Lake South Basin	Operations	7.1E-04
		Closure (pit flooding)	7.1E-04
	Whale Tail Pit	Closure (maintenance)	5.9E-04
		Post-Closure	4.0E-04
Cancer Endpoints[(a)]			
Arsenic	Mammoth Lake	Operations	1.4E-07
		Closure (pit flooding)	6.7E-08
		Closure (maintenance)	3.0E-07
		Post-Closure	1.5-06
	Lake A15	Operations	1.2E-07
		Closure (pit flooding)	6.1E-08
		Closure (maintenance)	2.8E-07
		Post-Closure	1.4E-06
	Lake A12	Operations	1.2E-07
		Closure (pit flooding)	6.0E-08
		Closure (maintenance)	2.8E-07
		Post-Closure	1.4E-06
	Lake A76	Operations	1.1E-07
		Closure (pit flooding)	5.5E-08
		Closure (maintenance)	2.6E-07
		Post-Closure	1.4E-06
	DS Node 2	Operations	9.7E-08
		Closure (pit flooding)	4.8E-08
		Closure (maintenance)	2.3E-07
		Post-Closure	1.3E-06
	Whale Tail Lake South Basin	Operations	1.5E-07
		Closure (pit flooding)	7.1E-08

COPC	Location(s)	Project Phase(s)	Expansion Project - Exposure Dose (mg/kg-d)
		Closure (maintenance)	5.4E-08
		Post-Closure	4.5E-07
	Whale Tail Pit	Closure (maintenance)	3.2E-07
		Post-Closure	1.6E-06
	IVR Pit	Closure (maintenance)	2.4E-07
		Post-Closure	1.3E-06

-- = not retained as a COPC; COPC = chemical of potential concern; mg/kg-d = milligrams per kilogram body weight per day.

(a) Note that cancer exposure for all project phases was evaluated, even if arsenic did not exceed its benchmark for that phase given that carcinogenic risks are additive over the life of the Project.

3.6.4 Risk Characterization

Using the approach described by Health Canada (2010) to calculate health risks for contaminated food and using a target HQ of 0.2 and target ILCR of 1E-05 (or 1 in 100,000), HQs and ILCRs were calculated for each location and COPC (Table 3.6-6 for the Approved Project and Table 3.6-7 for the Expansion Project).

Table 3.6-6: Risk Characterization for Fish Tissue Quality for the Approved Project

COPC	Location(s)	Project Phase(s)	Approved Project – Estimated Risks
Non-cancer Endpoints – Hazard Quotients			
Arsenic	Mammoth Lake	Operations	0.09
		Closure	0.1
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A15	Operations	0.08
		Closure	0.08
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A12	Operations	0.07
		Closure	0.07
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A76	Post-Closure (early)	--

COPC	Location(s)	Project Phase(s)	Approved Project – Estimated Risks
		Post-Closure (late)	--
	DS Node 2	Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Lake South Basin	Operations	--
		Closure	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--
	IVR Pit	Post-Closure (early)	--
		Post-Closure (late)	--
Manganese	Mammoth Lake	Operations	0.003
		Closure	0.004
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A15	Operations	0.002
		Closure	0.003
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A12	Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Lake A76	Operations	--
		Post-Closure (early)	--
		Post-Closure (late)	--
	Whale Tail Lake South Basin	Operations	--
		Closure	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--

COPC	Location(s)	Project Phase(s)	Approved Project – Estimated Risks
Cancer Endpoints[a] – Incremental Lifetime Cancer Risks			
Arsenic	Mammoth Lake	Operations	3.0E-06
		Closure	1.3E-06
		Post-Closure (early)	2.8E-06
		Post-Closure (late)	4.0E-06
		Total ILCR	1E-05
	Lake A15	Operations	2.7E-06
		Closure	1.1E-06
		Post-Closure (early)	2.8E-06
		Post-Closure (late)	3.7E-06
		Total ILCR	1E-05
	Lake A12	Operations	2.5E-06
		Closure	1.0E-06
		Post-Closure (early)	2.7E-06
		Post-Closure (late)	3.4E-06
		Total ILCR	1E-05
	Lake A76	Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
		Total ILCR	--
	DS Node 2	Operations	--
		Closure	--
		Post-Closure (early)	--
		Post-Closure (late)	--
		Total ILCR	--
	Whale Tail Lake South Basin	Operations	--
		Closure	--

COPC	Location(s)	Project Phase(s)	Approved Project – Estimated Risks
		Post-Closure (early)	--
		Post-Closure (late)	--
		Total ILCR	--
	Whale Tail Pit	Post-Closure (early)	--
		Post-Closure (late)	--
		Total ILCR	--
	IVR Pit	Post-Closure (early)	--
		Post-Closure (late)	--
		Total ILCR	--

Shaded and bold text = HQ > 0.2 or ILCR > 1E-05; -- = not retained as a COPC; COPC = chemical of potential concern; ILCR = incremental lifetime cancer risk.

(a) Note that cancer exposure for all project phases was evaluated, even if arsenic did not exceed its benchmark for that phase given that carcinogenic risks are additive over the life of the Project.

Table 3.6-7: Risk Characterization for Fish Tissue Quality for the Expansion Project

COPC	Location(s)	Project Phase(s)	Expansion Project - Estimated Risks
Non-cancer Endpoints – Hazard Quotients			
Arsenic	Mammoth Lake	Operations	0.007
		Closure (pit flooding)	0.009
		Closure (maintenance)	0.008
		Post-Closure	0.01
	Lake A15	Operations	0.007
		Closure (pit flooding)	0.008
		Closure (maintenance)	0.008
		Post-Closure	0.009
	Lake A12	Operations	0.006
		Closure (pit flooding)	0.008
		Closure (maintenance)	0.007
		Post-Closure	0.009
	Lake A76	Closure (maintenance)	0.007
		Post-Closure	0.008

COPC	Location(s)	Project Phase(s)	Expansion Project - Estimated Risks
	DS Node 2	Closure (maintenance)	0.006
		Post-Closure	0.008
	Whale Tail Lake South Basin	Operations	0.008
		Closure (pit flooding)	0.009
	Whale Tail Pit	Closure (maintenance)	0.008
		Post-Closure	0.01
	IVR Pit	Closure (maintenance)	0.006
		Post-Closure	0.008
Manganese	Mammoth Lake	Operations	0.005
		Closure (pit flooding)	0.003
		Closure (maintenance)	0.003
		Post-Closure	0.002
	Lake A15	Operations	0.003
		Closure (pit flooding)	0.002
		Closure (maintenance)	0.003
		Post-Closure	0.002
	Lake A12	Operations	0.003
		Closure (pit flooding)	0.002
		Closure (maintenance)	0.003
		Post-Closure	0.002
	Lake A76	Operations	0.002
		Closure (maintenance)	0.002
		Post-Closure	0.002
	Whale Tail Lake South Basin	Operations	0.005
		Closure (pit flooding)	0.005
	Whale Tail Pit	Closure (maintenance)	0.004
		Post-Closure	0.003

COPC	Location(s)	Project Phase(s)	Expansion Project - Estimated Risks
Cancer Endpoints[a] – Incremental Lifetime Cancer Risks			
Arsenic	Mammoth Lake	Operations	2.5E-07
		Closure (pit flooding)	1.2E-07
		Closure (maintenance)	5.4E-07
		Post-Closure	2.8E-06
		Total ILCR	4E-06
	Lake A15	Operations	2.2E-07
		Closure (pit flooding)	1.1E-07
		Closure (maintenance)	5.1E-07
		Post-Closure	2.6E-06
		Total ILCR	3E-06
	Lake A12	Operations	2.2E-07
		Closure (pit flooding)	1.1E-07
		Closure (maintenance)	5.0E-07
		Post-Closure	2.6E-06
		Total ILCR	3E-06
	Lake A76	Operations	1.9E-07
		Closure (pit flooding)	9.8E-08
		Closure (maintenance)	4.7E-07
		Post-Closure	2.5E-06
		Total ILCR	3E-06
	DS Node 2	Operations	1.7E-07
		Closure (pit flooding)	8.7E-08
		Closure (maintenance)	4.1E-07
		Post-Closure	2.3E-06
		Total ILCR	3E-06
	Whale Tail Lake South Basin	Operations	2.7E-07
		Closure (pit flooding)	1.3E-07

COPC	Location(s)	Project Phase(s)	Expansion Project - Estimated Risks
		Closure (maintenance)	9.7E-08
		Post-Closure	8.0E-07
		Total ILCR	1E-06
	Whale Tail Pit	Closure (maintenance)	5.7E-07
		Post-Closure	2.8E-06
		Total ILCR	3E-06
	IVR Pit	Closure (maintenance)	4.3E-07
		Post-Closure	2.3E-06
		Total ILCR	3E-06

Shaded and bold text = HQ > 0.2 or ILCR > 1E-05; -- = not retained as a COPC; COPC = chemical of potential concern; ILCR = incremental lifetime cancer risk.

(a) Note that cancer exposure for all project phases was evaluated, even if arsenic did not exceed its benchmark for that phase given that carcinogenic risks are additive over the life of the Project.

All calculated HQs were less than their target of 0.2, and all calculated ILCRs were less than their target of $1x10^{-5}$. Therefore, non-carcinogenic and carcinogenic health risks are not expected for members of the public that may rely on any of the assessed water bodies for fish should these receptors spend time in the area. As a result, fish tissue quality was not assessed further with respect to potential human health effects and no residual impacts due to changes to fish tissue quality were identified.

4.0 EFFECTS ASSESSMENT FOR WILDLIFE

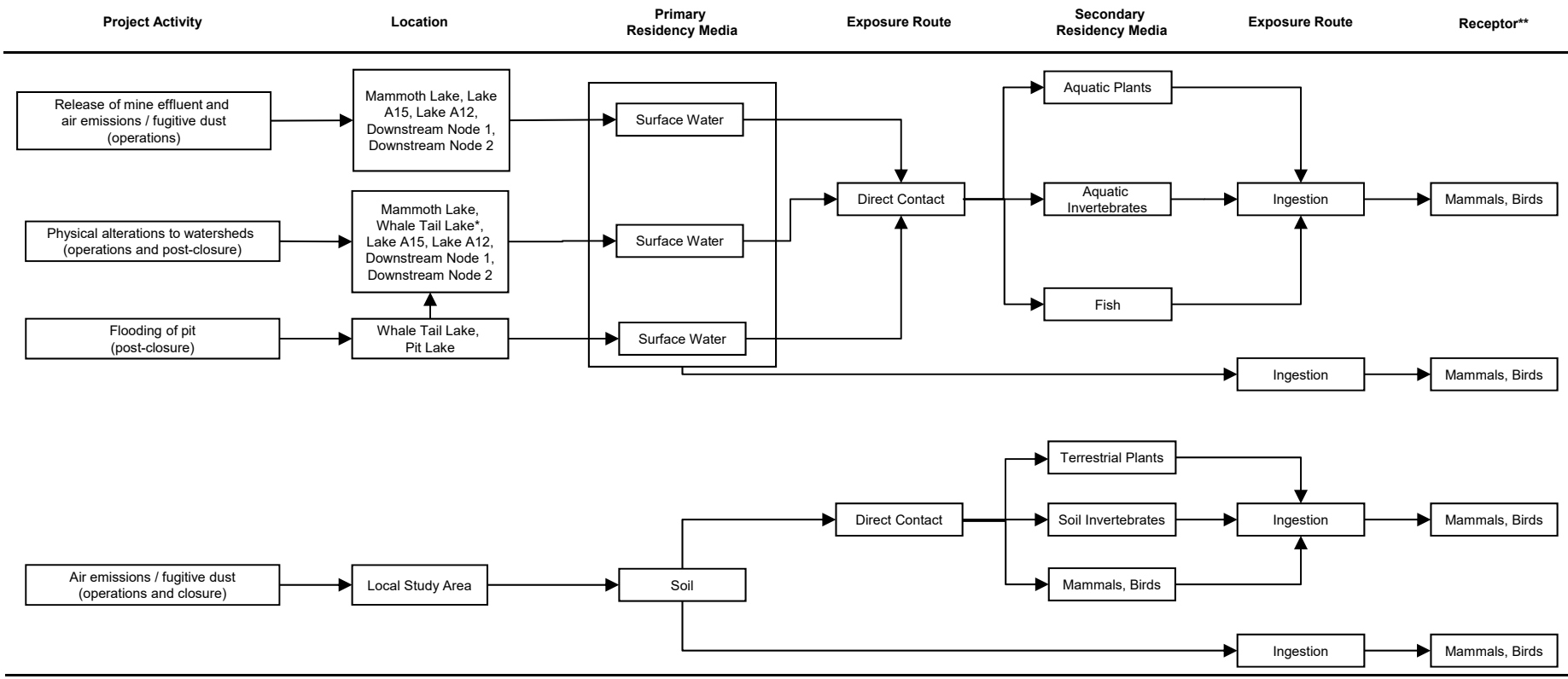
4.1 Conceptual Site Model

The CSM for wildlife receptors (Figure 4.1-1) was based upon the primary pathways identified above (Table 1.3-1). The exposure pathways between Approved Project and Expansion Project activities, intermediate residency media (i.e., the aspects of the environment that that may experience a change in quality due to project activities/emissions), and receptors are shown to be either complete or incomplete. Where pathways are incomplete, quantitative assessment was not carried out given that environmental quality was not anticipated to change as a result of the Approved Project or Expansion Project. Complete pathways on the figure indicate that a change to environmental quality was predicted and a quantitative assessment of the potential effects to human health was carried out. A brief summary of the complete exposure pathways are provided below for wildlife:

- incidental ingestion of soil;
- ingestion of surface water; and
- consumption of plants and animals as prey (e.g., sedges and forage fish).

Conceptual Site Model for the Project – Wildlife

FIGURE 4.1-1



NOTES

* For post-closure phase only.

** The receptors have been simplified to mammals and birds. The species of mammals and birds selected as receptors are described in Section 3-B-1.1 of Appendix 3-B of the FEIS Amendment.

LEGEND

Pathway incomplete and/or not evaluated

Pathway complete and evaluated

Date: June 17, 2016	Golder Associates	CAD: AA
Project: 1541520 (3500)		CKD: TMG

4.2 Air Quality

Direct effects to wildlife as a result of changes to air quality was not identified as a primary pathway. However, indirect effects due to particulate deposition onto soils and changes in soil quality were assessed further (see Section 4.3, below).

4.3 Soil Quality

4.3.1 Problem Formulation

Changes to soil quality as a result of the Approved Project and Expansion Project were predicted as described in Section 3.3.1. For the protection of wildlife, concentrations of chemicals in soil were screened against the CCME Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (CCME 1999b) for residential land use and the U.S. EPA Ecological Soil Screening Levels (U.S. EPA 2005b). If predicted concentrations for chemicals in soil were greater than the screening values and maximum baseline concentrations plus 10%, the chemical was identified as a COPC.

All concentrations in soil met their respective screening values and/or baseline plus 10% (Attachment 3-B-2) with the exception of sodium, which was greater than its baseline concentration +10% (no screening values are available for sodium). Sodium is naturally occurring and is present in the earth's crust at a concentration of 2.83% by weight (HSDB 2007); as a result, sodium was not retained as a COPC and therefore no COPCs were retained in soil and no residual impacts due to changes to soil quality were identified. Furthermore, given that no COPCs were identified for soil, no residual impacts to vegetation quality were identified. This result is consistent with the results of the conclusions of the previous risk assessments conducted at the Meadowbank Mine (described in Section 3.3.1).

4.4 Prey Quality

Given that no COPCs were identified in soil (Section 4.3), concentrations of chemicals in prey items (i.e., plants and animals consumed as prey) were not anticipated to change. As a result, prey items were not assessed further with respect to potential wildlife health effects and no residual health impacts due to changes to prey item quality were identified.

4.5 Water and Fish Quality

4.5.1 Problem Formulation

Similar to the human health assessment, effects on wildlife health were evaluated based on the waterbodies expected to be affected by discharges from the Project. Locations that were identified by the water quality effects assessment were assessed in the HHERA (Table 3.5-1 in Section 3.5.1). The concentrations of the COPCs identified in Section 3.5.1 (Table 3.5-2) were based upon comparison to screening values that are protective of human health and aquatic life; the only available screening values for application to wildlife are the Livestock Watering Guidelines from CCME and the British Columbia Ministry of Environment (BC MOE). For substances for which screening guidelines were available, all predicted concentrations were less than these guidelines; however, given that these guidelines are generally only for select parameters and are not intended to be protective of fish consumption (with the exception of selenium), screening values have been derived (Table 4.5-1) using the methods described in Sample et al. (1996) except allometric scaling of TRVs was not undertaken (Allard et al. 2010). The common loon was selected to represent fish-eating birds; no fish-eating mammals were identified (Table 4.5-1).

Table 4.5-1 provides the comparison of the maximum concentrations from all locations and all project phases to the CCME/BC MOE screening values and the derived screening values for the common loon.

Table 4.5-1: Chemicals of Potential Concern for Water Quality for Wildlife Receptors

Chemical	Approved Project - Maximum Concentration (µg/L)	Expansion Project - Maximum Concentration (µg/L)	CCME / BC MOE Livestock Watering (µg/L)	Screening Value for the Common Loon (µg/L)
Aluminum	322	5.8	5,000	800
Antimony	3.0	1	NV	NV
Arsenic	20	30	25	100
Barium	19	19	NV	200
Beryllium	0.025	0.033	100	NV
Bismuth	0.033	0.069	NV	NV
Boron	--	103	5000	NV
Cadmium	0.015	0.019	80	7
Chromium	9.0	0.95	50	6,900
Cobalt	0.53	0.75	1,000	NV
Copper	1.8	1.8	300	900
Iron	754	82	NV	NV
Lead	--	0.4	100	NV
Lithium	1.5	2.8	NV	NV
Manganese	51	132	NV	NV
Mercury	--	0.011	3	NV
Molybdenum	1.5	2.1	25	250
Nickel	4.6	8.7	1,000	4,400
Selenium	0.59	0.4	2	1.7
Silver	--	0.025	NV	NV
Strontium	34	66	NV	NV
Thallium	--	0.019	NV	NV
Tin	0.017	0.16	NV	370,000
Uranium	2.8	0.69	200	NV
Vanadium	1.2	1.2	100	NV
Zinc	2.0	3.2	2,000	44

-- = not reported for Approved Project; µg/L = micrograms per litre; NV = no value.

All predicted concentrations were less than these derived screening values. In the absence of a guideline, the aquatic life guidelines were used for screening purposes given that these would be considered protective of wildlife. Aquatic life guidelines are typically more protective than those set for the protection for wildlife and as a result, this is considered to be a conservative approach. As shown in the effects assessment for aquatic life (Section 5.0, below), these substances without derived screening guidelines were less than their respective aquatic life guidelines or toxicity benchmarks. As a result, no COPCs in water (or fish) were identified for evaluation of effects to wildlife, and no residual impacts due to changes in water and fish quality were identified.

5.0 EFFECTS ASSESSMENT FOR AQUATIC LIFE

5.1 Problem Formulation

The problem formulation develops a focussed understanding of how environmental quality might affect aquatic life near the Project. The problem formulation identifies the aquatic life expected to occur near the Project (i.e., receptors), the exposure pathways between aquatic life and chemicals released by the Approved Project and Expansion Project and the chemicals released by the Approved Project and Expansion Project that may be harmful to aquatic life (i.e., COPCs). The information from the problem formulation is summarized in a CSM, which illustrates the sources of COPCs (i.e., Approved Project and Expansion Project activities resulting in changes in environmental quality), the pathways of exposure and the receptors that are evaluated in the assessment.

Section 1.3 summarizes the environmental media that were assessed with respect to potential changes to environmental quality that may have an effect on human health, wildlife and aquatic life. Of these media, water quality is applicable and was considered further with respect to aquatic life.

Effects on aquatic life were evaluated based on the waterbodies expected to be affected by the Approved Project and Expansion Project. Locations that were identified by the water quality effects assessment were assessed for aquatic life. These locations were identified previously in Section 3.5.1.

5.1.1 Receptors

The aquatic valued components identified in Section 1.1 (Table 1.1-3) were selected as receptors for the effects assessment for aquatic life. These receptors include algae, aquatic plants, aquatic invertebrates and fish (Arctic char, Arctic Grayling, Lake Trout, and Round Whitefish). Rationale for selection of these receptors for the effects assessment is provided in Section 1.1.

5.1.2 Exposure Pathways

Aquatic receptors may come in contact with, or be exposed to, chemicals in surface water by direct contact with surface water and this exposure pathway was considered further in the effects assessment.

5.1.3 Chemicals of Potential Concern

Screening Process

Chemicals of potential concern in surface water were identified using a three-step process:

1) Step 1 of the screening process was previously described in Section 3.5.1. Parameters identified in Step 1 of the screening process were carried forward to Step 2 of the screening process.

2) In Step 2 of the screening process, maximum predicted concentrations were compared to long-term or chronic water quality guidelines protective of freshwater aquatic life. The following water quality guidelines were selected for the assessment:

   - Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-PFALs) (CCME 2018);
   - Federal Environmental Quality Guidelines (FEQGs) and screening assessments conducted on high priority substances as part of the Chemicals Management Plan pursuant to the *Canadian Environmental Protection Act*, 1999 (for vanadium, Environment Canada and Health 2010; for cobalt, Environment Canada 2013);
   - United States Environmental Protection Agency (U.S. EPA) National Recommended Water Quality Criteria for Aquatic Life (U.S. EPA 2016a) and other U.S. state criteria (for total dissolved solids [TDS] only);
   - British Columbia Water Quality Guidelines (approved and working water quality guidelines (BCMOE 2018; and BCMOE 2017); and
   - Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).

Preference was given to the CWQG-PFALs, and in the absence of these, the FEQGs/screening assessments. In the absence of these, the other available guidelines were used. These guidelines were considered appropriate for use because supporting documentation that details the development of the guidelines is available and they have been developed using approaches similar to those used in the development of the CWQG-PFALs and FEQGs/screening assessments.

For some parameters, guidelines are dependent on pH, temperature or hardness. For temperature and pH, measured baseline levels were used. Hardness was calculated from predicted calcium and magnesium concentrations in Mammoth Lake. For chromium, which has a guideline that is dependent on speciation, the most conservative guideline was used (i.e., hexavalent chromium).

Comparison to guidelines was considered to represent a conservative evaluation of the potential for the predicted concentrations to elicit adverse effects. Therefore, parameters with predicted concentrations below guidelines were considered to pose no risk to aquatic life and were not identified as COPCs. If the predicted concentration was greater than the guideline, the parameter was identified as a COPC and carried forward in the effects assessment. Parameters without guidelines were carried forward to the next step of the screening process.

3) In Step 3, the modelled parameters were assessed to determine which had the potential to adversely affect aquatic life and which parameters could be excluded from further consideration for one of the following reasons:

- The parameter has been shown to have limited potential to affect aquatic life (i.e., innocuous substances);
- Potential effects associated with the parameter was assessed elsewhere in the FEIS; and/or
- The parameter is a component of another parameter which is a more suitable focus point for the aquatic life effects assessment.

Parameters excluded during this step of the screening process were:

- *Phosphorus*, because potential effects related to eutrophication are assessed elsewhere in the FEIS; and
- *Alkalinity, calcium, magnesium, potassium and sodium*, because they are components of TDS, another modelled parameter included in the assessment.

Results

Based on the screening process outlined above, the following COPCs were identified for aquatic receptors for each modelled location and Project phase (Table 5.1-1 through 5.1-4).

Table 5.1-1: Chemicals of Potential Concern in Surface Waters during Operations

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin
Approved Project							
Arsenic	✓	✓	✓	-	×	✓	-
Lithium	✓	✓	✓	-	✓	✓	-
Strontium	✓	✓	✓	-	✓	✓	-
Expansion Project							
Arsenic	✓	✓	✓	✓	×	✓	✓
Lithium	✓	✓	✓	✓	✓	✓	✓
Strontium	✓	✓	✓	✓	×	✓	✓

✓ = chemical identified as a COPC for noted location; × = chemical not identified as a COPC for noted location; - = location not evaluation for Approved/Expansion Project; COPC = chemical of potential concern.

Table 5.1-2: Chemicals of Potential Concern in Surface Waters during Closure (Approved Project) and Closure - Pit Flooding (Expansion)

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin
Approved Project							
Fluoride	✓	×	×	-	×	×	-
Arsenic	✓	✓	✓	-	×	✓	-
Chromium	✓	×	×	-	×	×	-
Lithium	✓	✓	✓	-	✓	✓	-
Strontium	✓	✓	✓	-	✓	✓	-
Expansion Project							
Arsenic	✓	✓	✓	✓	×	✓	✓
Lithium	✓	✓	✓	✓	✓	✓	✓
Strontium	×	✓	✓	✓	×	✓	✓

✓ = chemical identified as a COPC for noted location; × = chemical not identified as a COPC for noted location; - = location not evaluation for Approved/Expansion Project; COPC = chemical of potential concern.

Table 5.1-3: Chemicals of Potential Concern in Surface Waters during Post-Closure Year 1 (Approved Project) and Closure Maintenance (Expansion Project)

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin	Whale Tail Pit	IVR Pit
Approved Project									
Arsenic	✓	✓	✓	-	×	×	-	-	-
Lithium	✓	✓	✓	-	✓	✓	-	-	-
Strontium	✓	✓	✓	-	✓	✓	-	-	-
Expansion Project									
Arsenic	✓	✓	✓	✓	×	✓	×	✓	✓
Lithium	✓	✓	✓	✓	✓	✓	✓	✓	✓
Strontium	×	✓	✓	✓	×	✓	✓	✓	✓

✓ = chemical identified as a COPC for noted location; × = chemical not identified as a COPC for noted location; - = location not evaluation for Approved/Expansion Project; COPC = chemical of potential concern.

Table 5.1-4: Chemicals of Potential Concern in Surface Waters during Long-Term Post-Closure (Approved Project) and Post-Closure (Expansion Project)

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake North	Whale Tail Lake South Basin	Whale Tail Pit	IVR Pit
Approved Project										
Aluminum	×	×	×	-	×	×	✓	-	×	-
Arsenic	×	×	×	-	×	×	✓	-	✓	-
Chromium	×	×	×	-	×	×	✓	-	×	-
Iron	×	×	×	-	×	×	✓	-	×	-
Lithium	✓	✓	✓	-	✓	✓	×	-	✓	-
Strontium	✓	✓	✓	-	✓	✓	×	-	✓	-
Expansion Project										
Arsenic	✓	✓	✓	✓	×	✓	-	×	✓	✓
Lithium	✓	✓	✓	✓	✓	✓	-	✓	✓	✓
Strontium	×	✓	✓	×	×	✓	-	✓	✓	✓

✓ = chemical identified as a COPC for noted location; × = chemical not identified as a COPC for noted location; - = location not evaluation for Approved/Expansion Project; COPC = chemical of potential concern.

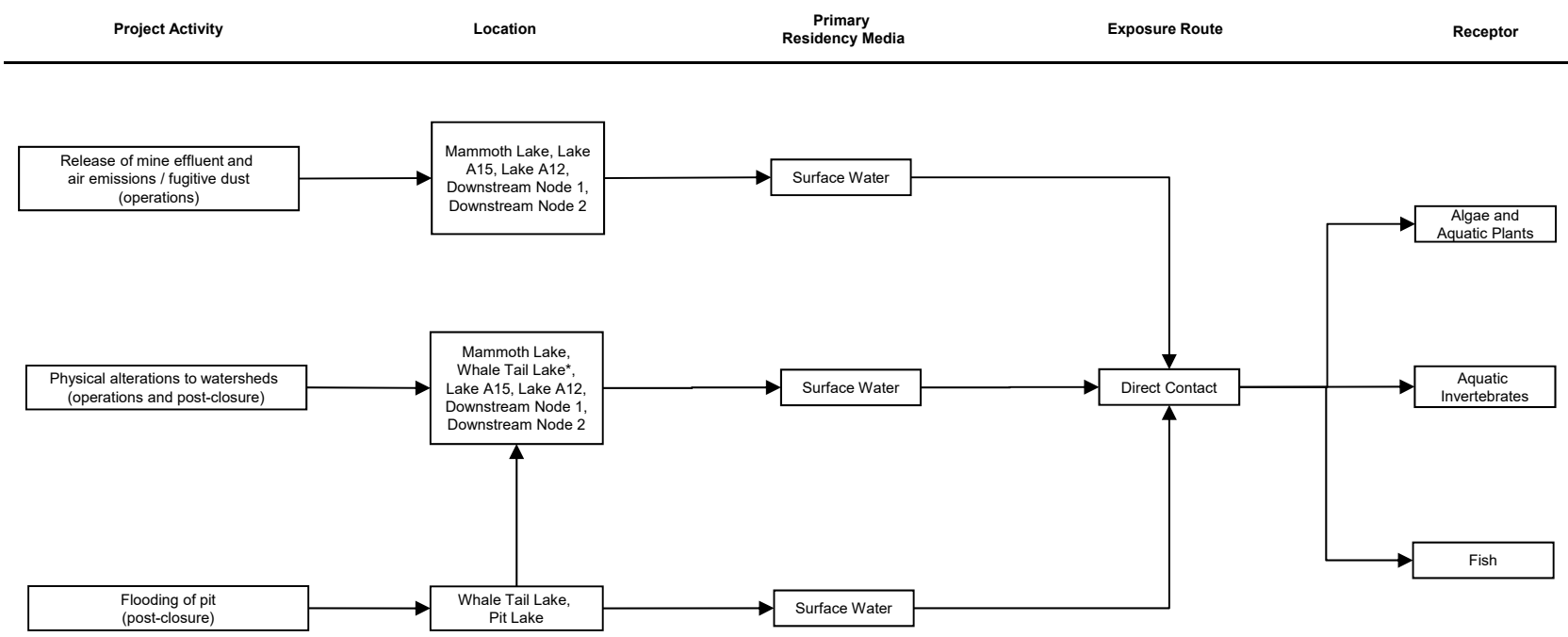
5.1.4 Conceptual Site Model

A CSM was developed for aquatic life based upon the primary pathways identified in Section 1.3 (Figure 5.1-1). The exposure pathways between Approved Project and Expansion Project activities, intermediate residency media (i.e., the aspects of the environment that may experience a change in quality due to project activities/emissions) and receptors are shown to be either complete or incomplete. Where pathways are incomplete, quantitative assessment was not carried out given that environmental quality was not anticipated to change as a result of the Approved Project or Expansion Project. Complete pathways indicate that a change to environmental quality was predicted and a quantitative assessment of potential effects to aquatic life was carried out.

To summarize, the effects assessment for aquatic life considered direct contact with surface water by algae, aquatic plants, aquatic invertebrates, and fish.

Conceptual Site Model for the Project – Aquatic Life

FIGURE 5.1-1



NOTES

* For post-closure phase only.

LEGEND

Pathway incomplete and/or not evaluated

Pathway complete and evaluated

Date: June 17, 2016	Golder Associates	CAD: SG
Project: 1541520 (3500)		CKD: TMG

5.2 Exposure Assessment and Toxicity Assessment

5.2.1 Exposure Assessment

The exposure assessment determines the amount of COPC to which each of the receptors is exposed via each complete exposure pathway. For aquatic life, exposure is expressed as the concentrations of the COPCs in the media to which the receptor is exposed (i.e., in µg/L in water). This permits the evaluation of exposure relative to the toxicity benchmarks that are also expressed in this way.

Exposure of aquatic receptors to COPCs was assessed using predicted maximum concentrations in water at the locations and for the Approved Project and Expansion Project phases summarized in Table 3.5-1. A COPC was only assessed for the locations and phases for which it was identified as a COPC. The predicted maximum concentrations for those locations and phases are provided in Table 5.2-1 to Table 5.2-4.

Table 5.2-1: Exposure Concentrations for Surface Water during Operations

COPC	Units	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin
Approved Project								
Arsenic	µg/L	18	16	15	-	-	6.3	-
Lithium	µg/L	1.7	1.5	1.5	-	0.58	0.95	-
Strontium	µg/L	43	39	38	-	11	22	-
Expansion Project								
Arsenic	µg/L	19	14	13	9.1	-	7.0	26
Lithium	µg/L	2.8	2.4	2.2	1.9	1.1	1.8	2.4
Strontium	µg/L	66	56	51	37	-	33	48

Exposure concentrations are the predicted maximum concentrations; µg/L = micrograms per litre; "-" = not a COPC for this phase and location.

Table 5.2-2: Exposure Concentrations for Surface Water during Closure (Approved Project) and Closure - Pit Flooding (Expansion Project)

COPC	Units	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin
Approved Project								
Fluoride	mg/L	0.14	-	-	-	-	-	-
Arsenic	µg/L	20	17	15	-	-	6	-
Chromium	µg/L	1.1	-	-	-	-	-	-
Lithium	µg/L	2.7	2.3	2.1	-	0.57	1	-
Strontium	µg/L	65	53	48	-	10	21	-
Expansion Project								
Arsenic	µg/L	17	13	12	9.1	-	5.0	26
Lithium	µg/L	2.0	1.8	1.8	1.7	1.1	1.4	2.4

COPC	Units	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin
Strontium	µg/L	-	33	32	29	-	19	48

Exposure concentrations are the predicted maximum concentrations; µg/L = micrograms per litre; mg/L = milligrams per litre; "-" = not a COPC for this phase and location.

Table 5.2-3: Exposure Concentrations for Surface Water during Post-Closure Year 1 (Approved Project) and Closure Maintenance (Expansion Project)

COPC	Units	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin	Whale Tail Pit	IVR Pit
Approved Project										
Arsenic	µg/L	8.5	8.3	8.1	-	-	-	-	-	-
Lithium	µg/L	1.9	1.8	1.7	-	0.64	1.1	-	-	-
Strontium	µg/L	45	42	40	-	12	25	-	-	-
Expansion Project										
Arsenic	µg/L	25	21	20	17	-	11	-	30	13
Lithium	µg/L	1.7	1.6	1.6	1.6	1.1	1.4	1.1	1.8	1.2
Strontium	µg/L	-	26	25	24	-	19	16	28	17

Exposure concentrations are the predicted maximum concentrations; µg = micrograms per litre; "-" = not a COPC for this phase and location.

Table 5.2-4: Exposure Concentrations for Surface Water during Long-Term Post-Closure (Approved Project) and Post-Closure (Expansion Project)

COPC	Units	Mammoth Lake	Lake A15	Lake A12	Lake A76	Down-stream Node 1	Down-stream Node 2	Whale Tail Lake North	Whale Tail Lake South	Whale Tail Pit	IVR Pit
Approved Project											
Aluminum	µg/L	-	-	-	-	-	-	322	-	-	-
Arsenic	µg/L	-	-	-	-	-	-	5.7	-	10	-
Chromium	µg/L	-	-	-	-	-	-	9	-	-	-
Iron	µg/L	-	-	-	-	-	-	754	-	-	-
Lithium	µg/L	1.1	1.1	1	-	0.57	0.81	-	-	1.5	-
Strontium	µg/L	26	24	23	-	10	17	-	-	34	-
Expansion Project											
Arsenic	µg/L	21	18	17	16	-	11	-	-	22	12
Lithium	µg/L	1.6	1.5	1.5	1.6	1.1	1.4	-	1.1	1.6	1.2
Strontium	µg/L	-	24	23	-	-	18	-	16	24	17

Exposure concentrations are the predicted maximum concentrations; µg/L = micrograms per litre; "-" = not a COPC for this phase and location.

5.2.2 Toxicity Assessment

The toxicity assessment characterizes potential effects associated with COPCs. It provides a basis for evaluating what is an acceptable exposure and what level of exposure may adversely affect the receptors. This involves determining concentrations that receptors can be exposed to without adverse effects. For aquatic life, this is expressed as an acceptable concentration in the media to which the receptor is exposed (i.e., in water in µg/L) and is referred to as the toxicity benchmark. These values are used as thresholds for comparison with exposure concentrations during risk characterization.

A toxicity assessment was completed to develop toxicity benchmarks for each of the COPCs identified in Section 5.1.3. The chronic toxicity benchmark derivation approach for each COPC was as follows:

- **Fluoride and Arsenic**: For fluoride, selection of a chronic toxicity benchmark recently derived using the Species Sensitivity Distribution (SSD) approach (McPherson et al. 2014) and for arsenic, development of a chronic toxicity benchmark using the SSD approach (Volume 6, Appendix 6-N). The SSD approach incorporates toxicity data from multiple species and allows for the determination of a benchmark that is protective of the aquatic community.
- **Aluminum**: Adoption of the U.S. EPA criterion continuous concentration (CCC) for freshwater aquatic life (U.S. EPA 2016a) as the chronic toxicity benchmark. Recent publications indicate that the complexation of aluminum under natural conditions yields reduced bioavailability and toxicity relative to the test conditions used in laboratory exposures (Wilson 2012). Factors that ameliorate toxicity of aluminum to freshwater aquatic life include complexation to dissolved organic matter (DOM), high water hardness and antagonistic (protective) effects of other elements including calcium, fluoride, and silicon (Gensemer and Playle 1999). In particular, aluminum toxicity is strongly influenced by the pH of the local environment, with increases in solubility/bioavailability and toxicity occurring as pH decreases below 6.5. Therefore, it was considered prudent to consider these exposure and toxicity modifying factors (ETMFs) in the development of a toxicity benchmark for aluminum. However, a technically defensible benchmark that reflects the full suite of ETMFs likely to be relevant to the Project could not be derived due to a lack of data. For example, focusing the literature review to exclude data with pH values that are not applicable to the Project (i.e., pH <6.5) would result in the exclusion of the majority of the data. The remaining limited dataset would reflect a range of exposure regimes that would also likely overstate the bioavailability of aluminum because they do not address the other factors known to ameliorate toxicity. As a result, the U.S. EPA criterion was adopted as the benchmark for aluminum. The U.S. EPA criterion was adopted over the CWQG-PFAL because of the lack of information regarding how the later was derived.
- **Chromium, lithium and strontium**: Selection of the lowest acceptable chronic toxicity values for use as the toxicity benchmarks. A search of the ECOTOXicology (ECOTOX) database (U.S. EPA 2016b) was done in 2016 to identify the lowest acceptable chronic toxicity values for use as the toxicity benchmarks (no new studies were identified in an updated search completed in October of 2018). The search included endpoints based on development, growth, population changes, reproduction and survival. The selection of toxicity values as benchmarks was based on the following order of precedence:
  - EC_x/IC_x representing a no-effects threshold;
  - EC_{10}/IC_{10};
  - $EC_{11\text{-}25}/IC_{11\text{-}25}$;

- Maximum Allowable Toxicant Concentration (MATC), calculated by taking the geometric mean of the NOEC and LOEC reported for a given test. The procedure can yield results that are comparable to IC_{25} results, as discussed for example in U.S. EPA (2007);
- No Observed Effect Concentration (NOEC);
- Lowest Observed Effect Concentration (LOEC);
- $EC_{26\text{-}49}/IC_{26\text{-}49}$; and
- Non-lethal EC_{50}/IC_{50}.

- **Iron**: Selection of a bioassessment-based benchmark. Iron bioavailability and toxicity to aquatic life in freshwater environments is complex and it is challenging to obtain meaningful toxicity data for this metal from laboratory studies. As an alternative approach to assess iron toxicity in the freshwater environment, Linton et al. (2007) established bioassessment-based benchmarks for total iron using field-based research. In brief, the decline in the maximum abundance of organisms along a gradient of increasing iron concentrations for eight different families of benthic invertebrates was modelled using field data from streams of West Virginia, USA. Two benchmarks were derived: 210 µg/L, which corresponds to no or minimal changes in community structure and function, and 1,740 µg/L, which corresponds to slight to moderate changes in community structure and function. These field-based benchmarks represent the most recent, available field-based research on iron toxicity and they address both the direct (toxic) and indirect (physical) effects of iron. The benchmarks were derived based on stream invertebrates such as mayflies, which have been reported as the most sensitive to iron (Phippen et al. 2008). The upper benchmark is similar to benchmarks derived by other researchers (e.g., 1.7 mg/L by Randall et al. [1999] based on laboratory tests with *Daphnia magna*) and to international criteria for iron (e.g., U.S. EPA 2016a; BC MOE 2016). The British Columbia Ministry used the work of Linton et al. (2007) in support of their guideline of 1 mg/L (Phippen et al. 2008). The U.S. EPA acute criterion of 1 mg/L for total iron was assumed to be protective of aquatic life "*based on field observations principally*" (U.S. EPA 1976). Thus, 1.74 mg/L was selected as the toxicity benchmark for iron.

The toxicity benchmarks for each COPC are summarized in Table 5.2-5.

Table 5.2-5: Toxicity Benchmarks for Chemicals of Potential Concern in Surface Water

COPC	Units	Toxicity Benchmark	Basis and Source of Toxicity Benchmark
Fluoride	mg/L	1.94	Generic chronic effect benchmark derived using the SSD approach (McPherson et al. 2014); HC_5 of 16 aquatic species (5 fish, 7 invertebrates, 4 algae/aquatic plants); considered to be conservatively protective because does not consider factors that can reduce toxicity (e.g., water hardness and temperature).
Aluminum	µg/L	87	U.S. EPA criterion continuous concentration (U.S. EPA 2016a).
Arsenic	µg/L	28	Toxicity benchmark derived using the SSD approach; HC_5 of 28 aquatic species (3 fish, 1 amphibian, 9 invertebrates, 15 algae/aquatic plants).
Chromium	µg/L	5	Lowest reported and acceptable chronic toxicity value in the U.S. EPA ECOTOX database (U.S. EPA 2016b); 14-d MATC for reproduction in *Ceriodaphnia dubia* exposed to Cr(VI) (Hickey 1989).
Iron	µg/L	1,740	Bioassessment-based benchmark for total iron developed using field-based research (Linton et al. 2007); allows for slight to moderate change to benthic community population structure while protecting the structure and function of the ecosystem.
Lithium	µg/L	250	Lowest reported and acceptable chronic toxicity value in the U.S. EPA ECOTOX database (U.S. EPA 2016b); 26-d MATC for growth of fathead minnow (*Pimephales promelas*) (Long et al. 1998).
Strontium	µg/L	315	Lowest reported and acceptable chronic toxicity value in the U.S. EPA ECOTOX database (U.S. EPA 2016b); 7-d LC_{18} for *Hyalella azteca* (Borgmann et al. 2005).

COPC = chemical of potential concern; HC_5 = hazardous concentration to 5% of species; d = day; MATC = maximum acceptable toxicant concentration; LC_{18} = lethal concentration required to kill 18% of the test population; Cr(VI) = hexavalent chromium; SSD = species sensitivity distribution; mg/L = milligrams per litre; µg/L = micrograms per litre.

5.3 Risk Characterization

Risk characterization determines the potential for risks to aquatic receptors. Risks to aquatic receptors were assessed on a quantitative basis by calculating HQs. The HQ is the ratio of the estimated exposure concentration from the exposure assessment (i.e., predicted concentration of COPC in surface water) to the chronic toxicity benchmark developed in the toxicity assessment. A target HQ of one was used in the assessment which is consistent with current guidance (CCME 1996). An HQ of less than one indicates that risks to aquatic life are not expected. An HQ of greater than one indicates the potential for risks to aquatic life. Chemicals of potential concern with HQs greater than one were considered further in the residual impact classification (Section 6.0).

5.3.1 Fluoride, Iron, Lithium and Strontium

The HQs for fluoride, iron, lithium and strontium were less than one for all modelled locations and Project phases, indicating that risks to aquatic life from these COPCs are negligible (Table 5.3-1 through Table 5.3-4).

Table 5.3-1: Hazard Quotients for Surface Water during Operations

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin
Approved Project							
Arsenic	0.64	0.57	0.54	-	-	0.23	-
Lithium	0.0068	0.0060	0.0060	-	0.0023	0.0038	-
Strontium	0.14	0.12	0.12	-	0.035	0.070	-
Expansion Project							
Arsenic	0.68	0.50	0.46	0.33	-	0.25	0.93
Lithium	0.011	0.0096	0.0088	0.0076	0.0044	0.0072	0.0096
Strontium	0.21	0.18	0.16	0.12	-	0.10	0.15

Shaded and bold text = hazard quotient > 1; "-" = Not a COPC for this phase and location; COPC = chemical of potential concern.

Table 3-B-2: Hazard Quotients for Surface Water during Closure (Approved Project) Closure Pit Flooding (Expansion Project)

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Downstream Node 1	Downstream Node 2	Whale Tail Lake South Basin
Approved Project							
Fluoride	0.072	-	-	-	-	-	-
Arsenic	0.71	0.61	0.54	-	-	0.21	-
Chromium	0.22	-	-	-	-	-	-
Lithium	0.011	0.0092	0.0084	-	0.0023	0.0040	-
Strontium	0.21	0.17	0.15	-	0.03	0.067	-
Expansion Project							
Arsenic	0.61	0.46	0.43	0.33	-	0.18	0.93
Lithium	0.0080	0.0072	0.0072	0.0068	0.0044	0.0056	0.0096
Strontium	-	0.10	0.10	0.092	-	0.060	0.15

Shaded and bold text = hazard quotient > 1; "-" = Not a COPC for this phase and location; COPC = chemical of potential concern.

Table 5.3-3: Hazard Quotients for Surface Water during Post-Closure Year 1 (Approved Project) and Closure Maintenance (Expansion Project)

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Down-stream Node 1	Down-stream Node 2	Whale Tail Lake South Basin	Whale Tail Pit	IVR Pit
Approved Project									
Arsenic	0.30	0.30	0.29	-	-	-	-	-	-
Lithium	0.0076	0.0072	0.0068	-	0.0026	0.0044	-	-	-
Strontium	0.14	0.13	0.13	-	0.038	0.079	-	-	-
Expansion Project									
Arsenic	0.89	0.75	0.71	0.61	-	0.39	-	**1.1**	0.46
Lithium	0.0068	0.0064	0.0064	0.0064	0.0044	0.0056	0.0044	0.0072	0.0048
Strontium	-	0.083	0.079	0.076	-	0.060	0.051	0.089	0.054

Shaded and bold text = hazard quotient > 1; "-" = Not a COPC for this phase and location; COPC = chemical of potential concern.

Table 5.3-4: Hazard Quotients for Surface Water during Long-Term Post-Closure (Approved Project) and Post-Closure (Expansion Project)

COPC	Mammoth Lake	Lake A15	Lake A12	Lake A76	Down-stream Node 1	Down-stream Node 2	Whale Tail Lake North	Whale Tail Lake South Basin	Whale Tail Pit	IVR Pit
Approved Project										
Aluminum	-	-	-	-	-	-	**3.7**	-	-	-
Arsenic	-	-	-	-	-	-	0.20	-	0.36	-
Chromium	-	-	-	-	-	-	**1.8**	-	-	-
Iron	-	-	-	-	-	-	0.43	-	-	-
Lithium	0.0044	0.0044	0.0040	-	0.0023	0.0032	-	-	0.0060	-
Strontium	0.083	0.076	0.073	-	0.032	0.054	-	-	0.108	-
Expansion Project										
Arsenic	0.75	0.64	0.61	0.57	-	0.39	-	-	0.79	0.43
Lithium	0.0064	0.0060	0.0060	0.0064	0.0044	0.0056	-	0.0044	0.0064	0.0048
Strontium	-	0.076	0.073	-	-	0.057	-	0.051	0.076	0.054

Shaded and bold text = hazard quotient > 1; "-" = Not a COPC for this phase and location; COPC = chemical of potential concern.

5.3.2 Aluminum, Arsenic, and Chromium

Hazard quotients for aluminum, arsenic, and chromium were less than one for all modelled locations and Project phases with the exception of the HQs for Whale Tail Pit during Expansion Project closure maintenance (HQ of 1.1 for arsenic) and Whale Tail Lake during Approved Project late post-closure (HQs of 3.7 and 1.8 for aluminum and chromium, respectively) (Table 5.3-1 through Table 5.3-4). Therefore, aluminum and chromium in Whale Tail Lake during post-closure for the Approved Project and arsenic in Whale Tail Pit for the Expansion Project were considered further in the residual impact classification (Section 6.0).

6.0 RESIDUAL IMPACT CLASSIFICATION

Residual impact classification was carried out using the methods described in Volume 3, Section 3.7. The residual impact classification was carried out for VCs and substances that may be associated with a potential residual impact as identified in the HHERA. No residual impacts were identified for human health or wildlife, but residual impacts were identified for aquatic life.

As discussed in Section 5.3.2, the HQs for aluminum and chromium for aquatic life were greater than the target HQ of one for Whale Tail Lake during post-closure, and the HQ for arsenic for aquatic life was greater than the target HQ of one for Whale Tail Pit during the Expansion Project closure maintenance. However, until the water quality in Whale Tail Pit meets the SSWQO the dyke will be maintained; therefore, it would not constitute fish habitat. There is no residual effect during the Expansion Project Post-closure phase; therefore, arsenic was not considered a risk for aquatic life.

Therefore, these COPCs were considered further in the residual impact classification. The following subsections evaluate potential residual impacts associated with aluminum and chromium.

6.1 Aluminum

The result of the residual impact assessment for aluminum in Whale Tail Lake North Basin during post-closure (late) for the Approved Project is provided in Table 6.1-1. When all criteria are considered, impacts to aquatic life resulting from aluminum at this location and for this phase of the Approved Project are expected to be not significant.

6.2 Chromium

The result of the residual impact assessment for chromium in Whale Tail Lake North Basin during post-closure (late) for the Approved Project is provided in Table 6.1-2. When all criteria are considered, impacts to aquatic life resulting from chromium at this location and for this phase of the Approved Project are expected to be not significant.

Table 6.1-1: Residual Impact Assessment for Aquatic Life for Aluminum

Assessment Criterion	Assigned Level	Rationale for Assigned Level
Direction	Negative	The toxicity benchmarks are intended to identify the potential for risks to aquatic life; therefore, where an HQ is greater than one, it indicates that risks to aquatic life are possible.
Magnitude[(a)]	Low	A low level was assigned because the calculated HQ was 3.7 (i.e., HQ was greater than 1 but less than 10).
Geographic Extent	Local	The potential effect is confined to Whale Tail Lake North Basin for the Approved Project (no impacts were identified for aluminum for the Expansion Project).
Duration	Unknown	The potential effect is evident during the one year of monthly predictions representing Year 10 of post-closure (Approved Project only).
Frequency	Continuous	The potential effect is evident during the one year of monthly predictions representing Year 10 of post-closure (Approved Project only).
Reversibility	Reversible	The effect may result in impacts on sensitive individuals but it is unlikely to result in population-level effects.
Likelihood	Unlikely	The likelihood of an effect on aquatic life is considered unlikely because: ■ The predicted HQ > 1 was predicted for the Approved Project only; no impacts were identified for the Expansion Project. ■ Aluminum can be extremely toxic under acidic (pH<6) or alkaline (pH>8) conditions, but has relatively low toxicity to freshwater aquatic life between pH 6 and 8 such that “it is not a toxicological problem in the majority of freshwater environments” (Wilson 2012, p 70). Baseline pH in Whale Tail Lake ranges upwards from pH 6.5. ■ As summarized in Wilson (2012), the U.S. EPA criterion (and toxicity benchmark used in this assessment) is highly conservative. For example, the criterion is based on “acid soluble” aluminum (acidified to pH <2 then 0.45 µm filtered) rather than dissolved aluminum. The criterion does not consider the formation of exposure and toxicity modifying complexes. In particular, complexation with DOC reduces aluminum bioavailability and toxicity; however, aluminum also forms complexes with chloride, fluoride, sulphate, nitrate and phosphate. Furthermore, differences in the aging of aluminum stock solutions before their dilution and delivery to toxicity test exposure tanks may have resulted in unrealistic toxicity in the criteria database – “transient and highly toxic effects can occur within the first seconds after a dosing solution is prepared, which can disappear following a suitable again period that can be as short as a few minutes (Wilson 2012, p 77). ■ HQs were calculated using total aluminum concentrations and a benchmark based on total aluminum. However, total aluminum may include forms that are not biologically reactive such as those organically complexed or adsorbed to particulates. Thus, use of total aluminum concentrations and a benchmark based on total aluminum can overestimate toxicity. It is widely accepted that the dissolved fraction of the total concentration is a better indicator of the bioavailable and toxic concentration to aquatic biota (BCMOE 1988). The BCMOE provides a long-term average water quality guideline for freshwater aquatic life at pH ≥6.5 for dissolved aluminum of 50 µg/L. The maximum concentration of dissolved aluminum in Whale Tail Lake during post-closure of 0.1 µg/L is well below the BCMOE guideline. ■ Low-level exposure to aluminum over time as in the case of waters downstream of the Project can provide increased resistance from chronic toxicity. As noted by Wilson (2012, p 104) tolerance with slow exposure to increasing aluminum concentrations “may explain the continued presence of fish populations in acidified soft waters containing levels of aluminum in excess of the threshold predicated by acute toxicity tests”. ■ The assumptions used in the water quality model are highly conservative and as such, the predicted concentrations of aluminum have likely been overestimated (for a summary of the conservative assumptions used in the water quality model refer to Volume 6, Section 6.4.3).

(a) Magnitude for aquatic life risk is as follows: Low = 1< HQ ≤10; Moderate = 10 < HQ ≤ 100; High = HQ > 100.

DOC = dissolved organic carbon; HQ = hazard quotient.

Table 6.1-2: Residual Impact Assessment for Aquatic Life for Chromium

Assessment Criterion	Assigned Level	Rationale for Assigned Level
Direction	Negative	The toxicity benchmarks are intended to identify the potential for risks to aquatic life; therefore, where an HQ is greater than one, it indicates that risks to aquatic life are possible.
Magnitude[(a)]	Low	A low level was assigned because the calculated HQ was 1.8 (i.e., HQ was greater than 1 but less than 10).
Geographic Extent	Local	The potential effect is confined to Whale Tail Lake North Basin for the Approved Project (no impacts were identified for chromium for the Expansion Project).
Duration	Unknown	The potential effect is evident during the one year of monthly predictions representing Year 10 of post-closure (Approved Project only).
Frequency	Continuous	The potential effect is evident during the one year of monthly predictions representing Year 10 of post-closure (Approved Project only).
Reversibility	Reversible	The effect may result in impacts on sensitive individuals but it is unlikely to result in population-level effects.
Likelihood	Unlikely	The likelihood of an effect on aquatic life is considered unlikely because: ■ The predicted HQ > 1 was predicted for the Approved Project only; no impacts were identified for the Expansion Project. ■ Predicted exposure concentrations for Whale Tail Lake North Basin are for total chromium. Chromium can exist in nine different oxidation forms; however, it is found most commonly in the trivalent (Cr^{3+}, or Cr [III]) and hexavalent (Cr^{6+}, or Cr [VI]) states in the environment. The toxicity, mobility, and bioavailability of chromium are highly dependent on these two valence states. In natural waters, Cr [VI] is more soluble, mobile and toxic than Cr [III]. Cr [VI] is the principal species found in surface waters (CCME 1999); therefore, the benchmark developed for chromium is for chromium (VI). However, if some fraction of the total concentration in Whale Tail Lake is Cr(III), the benchmark based on Cr (VI) may overestimate toxicity. ■ The toxicity benchmark represents the lowest reported and acceptable chronic toxicity value in the U.S. EPA ECOTOX database (U.S. EPA 2016b) and is thus considered to be conservative. The benchmark is a 14-d MATC of 5 µg/L for reproduction in *Ceriodaphnia dubia* exposed to Cr(VI) (Hickey 1989). In another study with *Ceriodaphnia dubia*, Baral et al. (2006) identified a 7-d IC_{25} for reproduction of 20 µg/L. Predicted chromium concentrations in Whale Tail Lake (9 µg/L) are below the effect concentration reported by Baral et al. (2006). The next lowest reported and acceptable toxicity value is a 28-d IC_9 for growth of *Daphnia schodleri* of 6.4 µg/L (Arzate-Cardenas and Martinez-Jeronimo 2012), and predicted chromium concentrations are also higher than this value. However, other daphnid species were less sensitive to chromium with effect concentrations ranging from 50 µg/L for *Daphnia magna* to 71 µg/L for *Daphnia carinata* (Hickey 1989) and predicted concentrations in Whale Tail Lake are below these effect concentrations. Therefore, although effects to highly sensitive aquatic invertebrate species are possible under predicted conditions, effects to a broader range of species, including fish are not expected to occur. ■ The assumptions used in the water quality model are highly conservative and as such, the predicted concentrations of chromium have likely been overestimated (for a summary of the conservative assumptions used in the water quality model refer to Volume 6, Section 6.4.3).

(a) Magnitude for aquatic life risk is as follows: Low = 1< HQ ≤10; Moderate = 10 < HQ ≤ 100; High = HQ > 100.

HQ = hazard quotient; Cr^{6+} and Cr(VI) = hexavalent chromium; Cr^{3+} and Cr(III) = trivalent chromium; MATC = maximum acceptable toxicant concentration; d = day; IC_x = inhibitory concentration (concentration at which x% impairment occurs in a response variable (e.g., reproduction)).

7.0 CUMULATIVE EFFECTS ASSESSMENT

Cumulative effects to air quality and surface water quality (Volume 4 and 6, respectively; Agnico Eagle 2018b) are expected to be negligible. Therefore, the subsequent effects to human health, wildlife and aquatic life are also expected to be negligible.

8.0 UNCERTAINTY

Table 8-1: Uncertainties in the Human Health and Ecological Risk Assessment

Source of Uncertainty	Overestimate/ Underestimate/ Neutral?
Baseline Data	
The maximum concentrations of measured data from air, soil, vegetation, water, and fish tissue were used to represent baseline in the HHERA. For screening purposes, the maximum concentrations plus 10% were used when determining whether predictions were expected to be measurably greater than baseline. This is considered to be a reasonable approach by neither over- nor underestimating the potential range of baseline concentrations.	Neutral
Model Predictions	
The concentrations of COPCs in air considered in the HHERA were the predicted maximum concentrations from the 5-year modelling dataset. It was conservatively assumed that the maximum emissions would occur throughout each phase of the Project	Overestimate
The concentrations of COPCs in water considered in the HHERA were the maximum monthly predictions out of one year of modelled data considering the maximum emissions from each phase of the Project. It was conservatively assumed that the maximum concentration could occur throughout each phase of the Project.	Overestimate
HHERA Assumptions	
Time spent at grave sites in the LSA is expected to be minimal. In general terms, visiting grave sites out on the land is not typically done, but people may stop and say a prayer or otherwise pay their respects if they happen across a grave site during their travels. However, the terrain in this area makes travel very difficult, such that even access by all-terrain vehicle in the summer is difficult, so the most likely access would be during the winter via skidoo. The presence of the haul road may make travel easier to this area, provided it is in the direction that people want to go. While it is possible that people may pass through this area on their way to the Back River, which is a good fishing spot, gas is expensive and the fisher would have to bring enough with them to get to Back River and back (as there is no way to get gas at Back River), and they will likely be going as quickly as possible to conserve gas and will not stop at grave sites (P. Burt, 2016, pers. comm.). Considering the above, time spent at Grave Sites 4 and 30 was considered to be 1.5 hours per day, which is a default time spent outdoors (Health Canada 2012), for 10 days per year. This would assume that a person may stop at a grave site both on their way to Back River and during their travel back, assuming they make the trip to Back River five times per year. This is considered to be an overestimation of time spent at a grave site in the LSA.	Overestimate
Although some caribou hunting could occur in the area, the areas identified in the TK report specifically identified two locations for muskox hunting, which is typically hunted when caribou are not available, and then can only be hunted in limited amounts based upon restrictions in the area (Golder 2015). It was considered that muskox hunting might occur for up to 14 days per year (i.e., a two-week trip or up to seven weekend trips). Exposure was considered to occur for 24 hours per day each day, as people would be spending most time outdoors and camping on the land.	Overestimate

Source of Uncertainty	Overestimate/ Underestimate/ Neutral?
The TK report identified two locations as fishing locations (Pipedream Lake and Nutipilik Lake). Neither of these locations were anticipated to be affected by the Approved Project nor Expansion Project, as these lakes were not included in the water quality modeling. Therefore, the assumption that people could spend up to 14 days per year (i.e., a two-week trip or up to seven weekend trips) at the lakes and water bodies included in the water quality model, consuming surface water as drinking water and consuming fish caught from the modeled lakes and water bodies, is considered to be an overprediction of potential exposure.	Overestimate
The site-specific water-to-fish BCFs derived in the HHERA relied upon measured baseline surface water quality data from Whale Tail Lake and Mammoth Lake. For the BCFs relied upon in the assessment of risks to human health, BCFs were derived considering tissue residue data for trout, while those for wildlife were derived using tissue residue data for forage fish. These BCFs may be biased high given that tissue residues that were less than their respective laboratory method detection limit were considered to be detections at the detection limit (i.e., a tissue residue of <0.010 mg/kg wet weight was considered to be equal to 0.010 mg/kg wet weight). Site-specific BCFs were not derived for substances for which all samples were less than method detection limits in either water, fish, or both. In these cases, BCFs from the literature were used.	Overestimate
For the Expansion Project, a refined approach to estimating fish tissue concentrations of arsenic based upon predicted water concentrations was used. The equation from Williams (2006) is based upon field and laboratory studies in which whole body tissue residues of total arsenic were measured in comparison to total arsenic in water, resulting in a range of BCFs and BAFs. A concentration-dependent relationship was established that was statistically significant, and this relationship is considered to provide a realistic estimation of fish tissue concentrations.	Neutral-Overestimate
The toxicity reference values used in the HHERA for human health and wildlife were selected from reputable sources including Health Canada and the U.S. EPA. The TRVs used in this RA are generally based on the most sensitive endpoints, with the application of safety factors to protect sensitive subpopulations. The uncertainty associated with TRVs is highly dependent on the number of studies available, and whether the key study was based on humans (low uncertainty) or small mammals (high uncertainty) in the case of the human health effects assessment, or the key study was based on species similar to those observed on-site (low uncertainty) or dissimilar (high uncertainty) in the case of the wildlife and aquatic effects assessments. When few studies are available, several types of safety factors must be applied to account for this uncertainty (e.g., factors for inter- and intraspecies sensitivity).	Neutral-Overestimate
The toxicity benchmarks for COPCs do not account for all of the factors known to modify exposure and toxicity to aquatic life.	Overestimate
Individual survival, growth, reproduction, development and population changes were used as endpoints for aquatic life but these do not necessarily translate to population-level effects which are considered ecologically relevant.	Overestimate
The potential for additive effects between COPCs was not considered for aquatic life.	Neutral-Underestimate
Acclimation and adaptation were not considered for aquatic life although natural populations chronically exposed to metals often exhibit increased tolerance to exposure relative to unexposed or naïve populations such as those used in laboratory studies upon which the toxicity benchmarks are based.	Overestimate
Other uncertainties are described in Table 6.1-1 and Table 6.1-2.	Overestimate

BAF = bioaccumulation factors; BCF = bioconcentration factors; COPC = chemicals of potential concern; TRV = toxicity reference value

9.0 MONITORING AND FOLLOW-UP

Monitoring and follow-up as described by other disciplines in the FEIS are applicable. These include monitoring of air quality criteria air contaminants (e.g., NO_2) and water quality (e.g. arsenic), which are implemented for both the Approved Project and Expansion Project. No additional monitoring or follow-up measures were identified in the HHERA.

10.0 CLOSURE

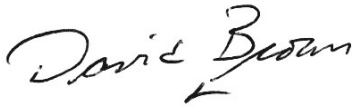
We trust this document satisfies you current requirements. If you have any questions or require further assistance, please do not hesitate to contact the undersigned.

Golder Associates Ltd.

for:

Andrea Amendola, B.Sc., QPRA
Senior Risk Assessor & Toxicologist

Ruwan Jayasinghe, M.Sc., QPRA, DABT
Senior Toxicologist & Risk Assessor



David Brown
Principal, Project Director

AA/MZG/DB/jr

https://golderassociates.sharepoint.com/sites/1896037/03_feis_typea_amendment/p3500_hhera/updated hhera may 2019/19115196-306-rpt-expansionproject_hhera-rev0.docx

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ATTACHMENT A

Baseline Conditions for Soil and Vegetation

INTRODUCTION

To evaluate the potential for adverse health effects to terrestrial life associated with changes in environmental quality due to chemical releases from the Project, the existing (or baseline) conditions of the environment must first be understood. This attachment provides baseline conditions for soil and vegetation.

METHODS

A field program was carried out to characterize the existing (or baseline) conditions of soil and vegetation quality. The program included the collection of soil and vegetation samples, and analysis of the samples for concentrations of metals. These baseline concentrations in soil and vegetation were used to provide context to the predicted changes to environmental quality as a result of the Project.

The soil and vegetation sampling program was designed to include the collection of vegetation samples of interest (i.e., berries, sedges [graminoids], and lichens) and co-located soil samples, while taking spatial distribution into account. Vegetation types selected for sampling were identified based on their importance as food for human consumption (e.g., berries) and primary forage type for wildlife considered in the assessment of human and ecological health risk (e.g., sedges [graminoids], and lichens). Soil and vegetation were sampled at 10 locations at the Whale Tail site (Figure 1). Sample collection took place from August 9 to August 16, 2015 and was completed by David Brown of Golder Associates Ltd.

Vegetation samples were collected in 10 sites around the proposed mine area (AER-01 to AER-10) areas where sufficient plant material of a given species was available. One duplicate sample (for soil, lichen, graminoid and berry) was collected at AER-08 and five replicates were taken at the replicate site at the north end of the road (AER-REP). Upon arriving at a suitable sampling site, Universal Transverse Mercator (UTM) coordinates were marked with a Garmin GPSMAP62s Global Positioning System device and photographs were taken in the four cardinal directions. The species of plant was identified and general notes regarding the plant's health and vigour were recorded. Unhealthy plants were only collected when there was insufficient healthy plant material available. Plant material that was dropped during collection was not included in the sample.

Berries were hand-picked and care was taken to avoid removing dust from their surface. They were collected from a minimum of three plants. Effort was made to pick ripe berries that someone would consider edible. Graminoids were collected by cutting the base of the aboveground growth with clean, titanium blade, non-stick coated scissors and folding the stems gently. Reindeer lichen (*Cladina* sp.) was lifted from the ground surface.

At least 10 g of each vegetation type was collected and placed in a plastic sample bag. Once the sample was collected, the air was squeezed out of the bag and the bag was sealed closed. Sample bags were labelled with the date, location, time, and sample identification, and then placed inside a second plastic bag. The second bag was labelled with the same information as the first bag and sealed closed.

Disposable nitrile gloves were worn to collect samples and gloves were changed between each sample to avoid cross contamination. Scissors were cleaned with phosphate-free dish detergent and rinsed with distilled water between each sample.

602000 604000 606000 608000 610000 612000

7258000 7256000 7254000 7252000 7250000

N

AER-09

AER-08

AER-10

Nemo Lake

Whale Tail Pit

Mammoth Lake

Whale Tail Lake

AER-07

AER-01

AER-02

AER-06

AER-03

AER-05

AER-REP

AER-04

LEGEND

- RISK SAMPLING SITE
- WHALE TAIL
- BORROW SOURCE
- INFRASTRUCTURE
- PROPOSED HAUL ROAD
- WATERCOURSE
- WATERBODY

REFERENCE

1. WHALE TAIL INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED ON DECEMBER 21, 2015.
2. MEADOWBANK INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED ON NOVEMBER 12, 2015.
3. WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
4. INSET MAP DATA OBTAINED FROM ESRI

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

800 0 800

METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

RISK SAMPLING SITES

Golder Associates

PROJECT		1541520	FILE No.	
DESIGN	PY	24 Feb. 2016	SCALE AS SHOWN	REV. 0
GIS	MH	10 Mar. 2016		
CHECK	AA	17 Jun. 2016		
REVIEW	RJ	17 Jun. 2016		

FIGURE 1

Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Whale_Tail\99_PROJECTS\1541520_FEIS\02_PRODUCTION\FEIS\MXD\3500_HHERA\Report\1541520_FIG_1_SAMPLING_LOCATIONS.mxd

Soil samples were collected at each location where berries, graminoids, or lichen samples were collected. Before collecting the samples, leaves and debris were cleared from the ground or water surface. A clean plastic hand trowel was used to collect a sample from the rooting zone or top 15 cm which was placed into a plastic Ziploc bag. All bags of soil were sealed and labelled with the location, date and sample identification. The sample bags were refrigerated until they were delivered to the laboratory for analysis. All samples were recorded on a chain-of-custody form, which was also placed in the coolers prior to delivery to the analytical laboratory. Laboratory analyses on vegetation and soil samples were performed by ALS Laboratories in Winnipeg, Manitoba. Samples were analyzed for the following suite of parameters:

- moisture content (plant tissue only);
- pH (soil only); and
- total metals (plant tissue and soil unless otherwise indicated): aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, cesium (plant tissue only), chromium (total), cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, phosphorus, potassium, rubidium (plant tissue only), selenium, silver (soil only),sodium, strontium, tellurium (plant tissue only), thallium, tin, titanium (soil only), uranium, vanadium, and zinc.

Mercury in vegetation was analyzed using cold vapour atomic absorption. Total metals in soil and vegetation were analyzed using inductively coupled plasma atomic emission spectroscopy and inductively coupled plasma mass spectrometry, respectively. The laboratory certificates of analyses are provided in Annex A-1.

A summary of soil and vegetation samples collected during the 2015 field program is presented in Table 1.

Table 1: Soil and Vegetation Sampled During the 2015 Field Program

Media	Number of Moisture Content Samples[(a)]	Number of Metals Samples[(a)]
Soil	-	16 (1)
Total Soil	**0**	**16 (1)**
Lichen	16 (1)	16 (1)
Grass/sedges	16 (1)	16 (1)
Berries	16 (1)	16 (1)
Total Vegetation	**48 (3)**	**48 (3)**

(a) Totals include field duplicate samples. Values in parentheses represent the number of duplicates.

Quality Assurance and Quality Control

Sample duplicates were collected for Quality Assurance and Quality Control (QA/QC) purposes. Duplicates provide an indication of natural sample variation and the reproducibility of the laboratory test methods. Duplicate samples were collected with 10% frequency, excluding the five replicates at AER-REP.

To obtain duplicate vegetation samples, two samples were collected from the sample location following the sampling methods described in above. Twice as much plant material was collected and the plant material was mixed thoroughly before dividing it into two bags. To obtain duplicate soil samples, two samples were collected from the

sample location following the methods described above, but twice as much sample was collected. The sample was mixed thoroughly in a large plastic bag before dividing it into plastic bags. Each duplicate sample was submitted to the laboratory for analyses via the methods and for the parameters identified above.

The results of the duplicate pair were expressed as a Relative Percent Difference (RPD). The RPD is an indicator of laboratory precision and sample heterogeneity. Lower RPD numbers indicate better precision in laboratory analysis and sample homogeneity. The formula for computing the RPD is given in the equation below:

$$RPD = \frac{|Sample - Duplicate|}{Mean} \times 100$$

Where:

RPD = relative percent difference (%);

Sample = concentration in original sample (µg/g);

Duplicate = concentration in duplicate sample (µg/g); and

Mean = average of the original sample and the duplicate sample (µg/g).

Relative percent differences were not calculated if concentrations were not detected in one or both of the duplicate samples. The calculated RPDs were compared to criteria established by the OMOE (2011). The QA/QC RPD criterion is 30% for all metals in soil (OMOE 2011). A criterion of 30% was used for vegetation, consistent with industry standard.

SOIL AND VEGETATION RESULTS

The results of the soil and sediment sampling program are presented in Annex A-2.

Soil collected around vegetation had concentrations of antimony, boron, selenium, silver and tin less than detection limits in all samples collected (Annex A-2, Table 1). The minimum and maximum concentrations for all metals in all samples were within an order of magnitude of each other, with the exception of chromium (i.e., 140 mg/kg in AER-SOIL-01 and 14.1 mg/kg in AER-SOIL-05), demonstrating there was little variability overall in metal concentrations between soil samples. Soil pH ranged from 4.59 to 5.69.

The results of the lichen sampling program are presented in Annex A-2, Table 2. Most metals were detected in lichen tissue. Only concentrations of tellurium were less than detection limits in all samples collected; lithium was not detected in all but one sample (AER-LI-10) and tin was not detected in all but two samples (AER-LI-07 and AER-LI-10). Some variability was observed in the metal concentrations between samples. The difference between the minimum and maximum concentrations were more than one order of magnitude for the following metals: aluminum, beryllium, bismuth, cesium, cobalt, iron, lead, manganese, mercury, nickel, rubidium, selenium, sodium, strontium, thallium, uranium, vanadium, and zirconium. Moisture content also varied widely, ranging from 10.1 to 81.0%.

The results of the graminoid sampling program are presented in Annex A-2, Table 3. As in lichen tissue, most metals were detected in graminoid tissue. Only concentrations of lithium were less than detection limits in all samples collected; tin was not detected in all but one sample (AER-GR-10) and tellurium was not detected in all but two samples (AER-GR-06 and AER-GR-10). Some variability was observed in the metal concentrations between samples. The difference between the minimum and maximum concentrations were more than one order of

magnitude for the following metals: antimony, lead, molybdenum, rubidium, thallium, and uranium. Moisture content ranged from 36.1 to 62.0%.

The results of the berry sampling program are presented in Annex A-2, Table 4. Concentrations of metals were less than detection limits in all samples collected for the following metals: antimony, arsenic, beryllium, bismuth, chromium, lead, lithium, mercury, selenium, sodium, tellurium, thallium, uranium, vanadium, and zirconium. Cesium and molybdenum were detected in one sample (AER-BER-04). Variability was observed in the metal concentrations between samples. The maximum concentration was over an order of magnitude greater than the minimum concentration for the following metals: aluminum, iron, and manganese. Moisture content ranged from 75.5 to 88.1%.

Quality Assurance and Quality Control

One duplicate sample of each vegetation type (berry, graminoid, and lichen) and co-located soil was collected during the 2015 sampling program at location AER-08 and analyzed for metals.

The RPDs for duplicates for metal concentrations in soil are presented in Annex A-2, Table 5. The RPDs for the soil duplicates were within the 30% criterion for all metals with the exception of mercury (95%) and zirconium (56%). These results suggest that the soils in the vicinity of the vegetation have a low degree of heterogeneity.

The RPDs for duplicates for metal concentrations in vegetation are presented in Annex A-2, Table 6. The RPDs for the lichen and graminoid duplicates were above the 30% criterion for 26 and 19 metal parameters, respectively. These results suggest that the metals concentrations in lichen and graminoid vegetation have some degree of heterogeneity. The RPD for the berry duplicates did not exceed the 30% criterion for any of the metal parameters, indicating that metals concentrations in berries are relatively homogenous.

Duplicate samples that have larger variation indicate high sample variability, which can be attributed to laboratory analysis, sampling technique or natural sample heterogeneity. Specific procedures were followed in the field during the collection of duplicate soil samples (i.e., sample homogenization) to reduce the effect of sampling techniques on variability. In addition, the results of the laboratory QA/QC analyses performed by ALS on both soil and vegetation fell within acceptable control limits for most samples, suggesting laboratory analyses would not be a large source of variability for either of these media.

For soils, the majority of the variability observed is likely attributed to the natural heterogeneity of soils. Almost all natural soils are highly variable and rarely homogeneous. Soil heterogeneity can be classified into two main categories. The first is lithological heterogeneity, which can be manifested in the form of different lithology within a more uniform soil mass. The second source of heterogeneity can be attributed to inherent spatial soil variability, which is the variation of soil properties from one point to another in space due to different deposition conditions.

REFERENCES

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ANNEX A-1

Laboratory Certificates of Analyses

AGNICO-EAGLE MINES LTD.
ATTN: RYAN VANENGEN
Meadowbank Division
Environment Department
Baker Lake Nunavut X0C 0A0

Date Received: 21-AUG-15
Report Date: 30-SEP-15 15:00 (MT)
Version: FINAL

Client Phone: 775-651-2974

Certificate of Analysis

Lab Work Order #: L1661327

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SLRA
C of C Numbers:
Legal Site Desc:

Ariel Tang, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1661327-1	L1661327-5	L1661327-9	L1661327-13	L1661327-17
Description	Soil	Soil	Soil	Soil	Soil
Sampled Date	14-AUG-15	14-AUG-15	14-AUG-15	14-AUG-15	14-AUG-15
Sampled Time					
Client ID	AER-SOIL-01	AER-SOIL-02	AER-SOIL-03	AER-SOIL-REP2	AER-SOIL-REP3
Grouping / **Analyte**					
SOIL					
Physical Tests pH (1:2 soil:water) (pH)	5.17	4.92	5.41	5.37	5.67
Metals Aluminum (Al) (mg/kg)	9150	6270	6030	6200	9960
Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As) (mg/kg)	8.23	3.39	2.87	4.41	5.66
Barium (Ba) (mg/kg)	14.1	21.9	19.5	21.6	46.5
Beryllium (Be) (mg/kg)	0.22	0.29	0.28	0.33	0.54
Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	0.27
Boron (B) (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium (Cd) (mg/kg)	0.061	0.047	0.026	0.036	0.047
Calcium (Ca) (mg/kg)	1550	1970	2680	2650	3110
Chromium (Cr) (mg/kg)	140	27.2	44.3	23.3	38.7
Cobalt (Co) (mg/kg)	11.6	4.49	4.20	5.49	7.96
Copper (Cu) (mg/kg)	5.50	4.34	4.99	4.76	8.02
Iron (Fe) (mg/kg)	21200	14800	13600	17800	21500
Lead (Pb) (mg/kg)	5.16	5.86	5.10	5.71	7.46
Lithium (Li) (mg/kg)	11.3	6.4	7.5	7.4	11.7
Magnesium (Mg) (mg/kg)	8810	3210	3640	3520	5210
Manganese (Mn) (mg/kg)	450	185	147	206	310
Mercury (Hg) (mg/kg)	0.0119	0.0184	<0.0050	<0.0050	0.0107
Molybdenum (Mo) (mg/kg)	0.43	0.47	0.25	0.32	0.51
Nickel (Ni) (mg/kg)	62.9	14.3	17.7	14.9	24.5
Phosphorus (P) (mg/kg)	328	325	487	615	479
Potassium (K) (mg/kg)	630	670	650	740	1230
Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na) (mg/kg)	<50	75	<50	52	66
Strontium (Sr) (mg/kg)	19.1	21.3	26.0	24.5	32.4
Thallium (Tl) (mg/kg)	<0.050	0.060	0.052	0.056	0.102
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg)	374	535	583	491	754
Uranium (U) (mg/kg)	0.900	1.99	1.80	2.17	2.77
Vanadium (V) (mg/kg)	24.0	12.4	13.0	12.2	17.6
Zinc (Zn) (mg/kg)	36.5	25.5	23.4	28.9	41.4
Zirconium (Zr) (mg/kg)	<1.0	1.6	7.0	6.9	4.7

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-21 Soil 14-AUG-15 AER-SOIL-REP4	L1661327-25 Soil 14-AUG-15 AER-SOIL-REP5	L1661327-29 Soil 14-AUG-15 AER-SOIL-04	L1661327-33 Soil 14-AUG-15 AER-SOIL-05	L1661327-37 Soil 14-AUG-15 AER-SOIL-06
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	5.47	5.64	5.62	5.05	5.25
Metals	Aluminum (Al) (mg/kg)	6140	8860	7190	6300	7310
	Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As) (mg/kg)	3.26	4.14	2.45	2.04	2.72
	Barium (Ba) (mg/kg)	22.3	32.9	39.7	28.2	32.8
	Beryllium (Be) (mg/kg)	0.28	0.44	0.40	0.36	0.43
	Bismuth (Bi) (mg/kg)	<0.20	0.22	0.20	0.21	0.30
	Boron (B) (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Cadmium (Cd) (mg/kg)	0.031	0.043	0.032	0.037	0.035
	Calcium (Ca) (mg/kg)	2670	3440	3070	2020	3170
	Chromium (Cr) (mg/kg)	23.5	32.7	14.9	14.1	19.8
	Cobalt (Co) (mg/kg)	4.82	7.25	4.98	4.08	4.74
	Copper (Cu) (mg/kg)	4.73	6.03	4.44	3.45	10.1
	Iron (Fe) (mg/kg)	14000	19300	16900	15100	16600
	Lead (Pb) (mg/kg)	5.19	6.78	4.95	5.70	7.92
	Lithium (Li) (mg/kg)	6.7	10.1	8.2	7.2	8.1
	Magnesium (Mg) (mg/kg)	3300	4650	3550	2920	3440
	Manganese (Mn) (mg/kg)	168	279	242	202	199
	Mercury (Hg) (mg/kg)	<0.0050	0.0078	0.0057	0.0131	0.0069
	Molybdenum (Mo) (mg/kg)	0.31	0.41	0.27	0.26	0.32
	Nickel (Ni) (mg/kg)	15.8	19.9	9.05	7.87	10.6
	Phosphorus (P) (mg/kg)	455	507	520	361	551
	Potassium (K) (mg/kg)	730	1060	710	690	830
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	<50	63	74	68	70
	Strontium (Sr) (mg/kg)	29.3	37.8	31.8	21.7	36.7
	Thallium (Tl) (mg/kg)	0.052	0.081	<0.050	0.053	0.063
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	600	740	698	590	694
	Uranium (U) (mg/kg)	1.75	2.43	1.47	1.26	1.92
	Vanadium (V) (mg/kg)	11.8	16.7	17.4	13.3	15.2
	Zinc (Zn) (mg/kg)	25.5	36.2	29.2	27.7	31.7
	Zirconium (Zr) (mg/kg)	5.9	4.7	7.1	1.9	7.3

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-41 Soil 14-AUG-15 AER-SOIL-07	L1661327-45 Soil 15-AUG-15 AER-SOIL-08	L1661327-49 Soil 15-AUG-15 AER-SOIL-08-DUP	L1661327-53 Soil 15-AUG-15 AER-SOIL-09	L1661327-57 Soil 15-AUG-15 AER-SOIL-10
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	4.98	5.26	5.62	5.69	4.59
Metals	Aluminum (Al) (mg/kg)	6390	7190	8370	9360	8450
	Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As) (mg/kg)	3.48	12.2	12.9	8.00	4.94
	Barium (Ba) (mg/kg)	21.2	73.9	86.8	48.4	14.3
	Beryllium (Be) (mg/kg)	0.31	0.36	0.40	0.35	0.26
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Cadmium (Cd) (mg/kg)	0.045	0.041	0.042	0.038	0.031
	Calcium (Ca) (mg/kg)	1540	3150	3620	3280	1130
	Chromium (Cr) (mg/kg)	29.2	45.9	55.1	94.1	70.0
	Cobalt (Co) (mg/kg)	4.27	7.34	8.07	9.10	6.34
	Copper (Cu) (mg/kg)	3.47	6.55	7.91	9.71	2.94
	Iron (Fe) (mg/kg)	15800	16300	18300	20900	19400
	Lead (Pb) (mg/kg)	6.77	6.11	6.86	4.72	4.60
	Lithium (Li) (mg/kg)	7.7	8.7	10.4	10.7	9.3
	Magnesium (Mg) (mg/kg)	3250	4930	5850	6710	5870
	Manganese (Mn) (mg/kg)	169	264	280	246	196
	Mercury (Hg) (mg/kg)	0.0160	0.0249	0.0089	0.0055	0.0061
	Molybdenum (Mo) (mg/kg)	0.28	0.32	0.33	0.29	0.33
	Nickel (Ni) (mg/kg)	11.0	23.5	27.3	38.7	33.1
	Phosphorus (P) (mg/kg)	358	735	859	755	232
	Potassium (K) (mg/kg)	710	1480	1890	1540	580
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	53	66	85	55	<50
	Strontium (Sr) (mg/kg)	12.7	36.6	42.6	30.0	21.1
	Thallium (Tl) (mg/kg)	0.053	0.093	0.114	0.087	<0.050
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	572	683	798	716	304
	Uranium (U) (mg/kg)	0.962	1.36	1.56	1.30	0.977
	Vanadium (V) (mg/kg)	17.0	20.1	23.0	25.0	18.8
	Zinc (Zn) (mg/kg)	25.4	27.6	31.5	30.1	27.8
	Zirconium (Zr) (mg/kg)	1.8	2.6	4.6	6.9	1.2

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1661327-61				
	Description	Soil				
	Sampled Date	14-AUG-15				
	Sampled Time					
	Client ID	AER-SOIL-REP1				
Grouping	**Analyte**					
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	5.68				
Metals	Aluminum (Al) (mg/kg)	9350				
	Antimony (Sb) (mg/kg)	<0.10				
	Arsenic (As) (mg/kg)	5.13				
	Barium (Ba) (mg/kg)	39.2				
	Beryllium (Be) (mg/kg)	0.53				
	Bismuth (Bi) (mg/kg)	0.25				
	Boron (B) (mg/kg)	<5.0				
	Cadmium (Cd) (mg/kg)	0.037				
	Calcium (Ca) (mg/kg)	3430				
	Chromium (Cr) (mg/kg)	36.7				
	Cobalt (Co) (mg/kg)	9.01				
	Copper (Cu) (mg/kg)	7.39				
	Iron (Fe) (mg/kg)	21200				
	Lead (Pb) (mg/kg)	7.37				
	Lithium (Li) (mg/kg)	10.7				
	Magnesium (Mg) (mg/kg)	4990				
	Manganese (Mn) (mg/kg)	421				
	Mercury (Hg) (mg/kg)	0.0084				
	Molybdenum (Mo) (mg/kg)	0.44				
	Nickel (Ni) (mg/kg)	23.6				
	Phosphorus (P) (mg/kg)	436				
	Potassium (K) (mg/kg)	1110				
	Selenium (Se) (mg/kg)	<0.20				
	Silver (Ag) (mg/kg)	<0.10				
	Sodium (Na) (mg/kg)	113				
	Strontium (Sr) (mg/kg)	37.6				
	Thallium (Tl) (mg/kg)	0.091				
	Tin (Sn) (mg/kg)	<2.0				
	Titanium (Ti) (mg/kg)	816				
	Uranium (U) (mg/kg)	3.08				
	Vanadium (V) (mg/kg)	17.4				
	Zinc (Zn) (mg/kg)	36.8				
	Zirconium (Zr) (mg/kg)	4.7				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-2 Tissue 14-AUG-15 AER-LI-01	L1661327-3 Tissue 14-AUG-15 AER-GR-01	L1661327-4 Tissue 14-AUG-15 AER-BER-01	L1661327-6 Tissue 14-AUG-15 AER-LI-02	L1661327-7 Tissue 14-AUG-15 AER-GR-02
TISSUE						
Physical Tests	% Moisture (%)	15.0	55.4	81.9	12.5	50.1
Metals	Aluminum (Al)-Total (mg/kg wwt)	55.1	12.5	7.78	33.1	27.5
	Antimony (Sb)-Total (mg/kg wwt)	0.0021	<0.0020	<0.0020	0.0022	<0.0020
	Arsenic (As)-Total (mg/kg wwt)	0.0636	0.0129	<0.0040	0.0454	0.0191
	Barium (Ba)-Total (mg/kg wwt)	5.43	10.9	0.150	7.87	11.2
	Beryllium (Be)-Total (mg/kg wwt)	0.0037	<0.0020	<0.0020	0.0065	0.0154
	Bismuth (Bi)-Total (mg/kg wwt)	0.0030	0.0058	<0.0020	0.0026	<0.0020
	Boron (B)-Total (mg/kg wwt)	0.25	2.34	0.27	0.31	1.44
	Cadmium (Cd)-Total (mg/kg wwt)	0.0387	0.0110	<0.0010	0.0398	0.0363
	Calcium (Ca)-Total (mg/kg wwt)	770	925	18.0	1030	1070
	Cesium (Cs)-Total (mg/kg wwt)	0.0122	0.0066	<0.0010	0.0169	0.0149
	Chromium (Cr)-Total (mg/kg wwt)	0.470	0.109	<0.010	0.180	0.144
	Cobalt (Co)-Total (mg/kg wwt)	0.180	0.0498	0.0041	0.0808	0.215
	Copper (Cu)-Total (mg/kg wwt)	0.807	1.61	0.062	0.639	1.69
	Iron (Fe)-Total (mg/kg wwt)	80.6	29.7	8.14	46.4	57.8
	Lead (Pb)-Total (mg/kg wwt)	0.220	0.0292	<0.0040	0.292	0.104
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	362	704	21.7	217	553
	Manganese (Mn)-Total (mg/kg wwt)	74.8	155	0.333	71.3	325
	Mercury (Hg)-Total (mg/kg wwt)	0.0443	0.0053	<0.0010	0.0714	0.0083
	Molybdenum (Mo)-Total (mg/kg wwt)	0.0149	0.157	<0.0040	0.0157	0.197
	Nickel (Ni)-Total (mg/kg wwt)	0.725	2.53	0.135	0.314	1.86
	Phosphorus (P)-Total (mg/kg wwt)	289	481	35.1	209	365
	Potassium (K)-Total (mg/kg wwt)	860	3940	255	860	5080
	Rubidium (Rb)-Total (mg/kg wwt)	0.962	1.74	0.124	1.93	6.10
	Selenium (Se)-Total (mg/kg wwt)	0.031	<0.010	<0.010	0.045	<0.010
	Sodium (Na)-Total (mg/kg wwt)	11.2	7.2	<4.0	16.0	9.5
	Strontium (Sr)-Total (mg/kg wwt)	2.15	3.57	0.050	3.12	4.99
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	0.00184	0.00354	<0.00040	0.00384	0.00109
	Tin (Sn)-Total (mg/kg wwt)	<0.020	<0.020	<0.020	<0.020	<0.020
	Uranium (U)-Total (mg/kg wwt)	0.00701	0.00112	<0.00040	0.00761	0.0164
	Vanadium (V)-Total (mg/kg wwt)	0.102	0.023	<0.020	0.057	0.034
	Zinc (Zn)-Total (mg/kg wwt)	11.4	14.6	0.41	10.8	16.9
	Zirconium (Zr)-Total (mg/kg wwt)	0.069	<0.040	<0.040	0.051	0.042

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-8 Tissue 14-AUG-15 AER-BER-02	L1661327-10 Tissue 14-AUG-15 AER-LI-03	L1661327-11 Tissue 14-AUG-15 AER-GR-03	L1661327-12 Tissue 14-AUG-15 AER-BER-03	L1661327-14 Tissue 14-AUG-15 AER-LI-REP2
TISSUE						
Physical Tests	% Moisture (%)	86.8	11.3	40.1	81.4	25.5
Metals	Aluminum (Al)-Total (mg/kg wwt)	<0.40	89.6	26.1	<0.40	23.4
	Antimony (Sb)-Total (mg/kg wwt)	<0.0020	0.0045	<0.0020	<0.0020	<0.0020
	Arsenic (As)-Total (mg/kg wwt)	<0.0040	0.0923	0.0312	<0.0040	0.0444
	Barium (Ba)-Total (mg/kg wwt)	0.263	12.6	16.5	0.266	3.61
	Beryllium (Be)-Total (mg/kg wwt)	<0.0020	0.0123	0.0051	<0.0020	<0.0020
	Bismuth (Bi)-Total (mg/kg wwt)	<0.0020	0.0044	<0.0020	<0.0020	0.0032
	Boron (B)-Total (mg/kg wwt)	<0.20	0.66	1.58	<0.20	0.25
	Cadmium (Cd)-Total (mg/kg wwt)	0.0011	0.0555	0.0135	<0.0010	0.0358
	Calcium (Ca)-Total (mg/kg wwt)	25.7	2330	1380	35.6	745
	Cesium (Cs)-Total (mg/kg wwt)	<0.0010	0.0249	0.0104	<0.0010	0.0076
	Chromium (Cr)-Total (mg/kg wwt)	<0.010	0.715	0.348	<0.010	0.187
	Cobalt (Co)-Total (mg/kg wwt)	<0.0040	0.287	0.127	<0.0040	0.0216
	Copper (Cu)-Total (mg/kg wwt)	0.084	1.12	1.33	0.213	0.637
	Iron (Fe)-Total (mg/kg wwt)	<0.60	145	61.3	<0.60	36.4
	Lead (Pb)-Total (mg/kg wwt)	<0.0040	0.304	0.0883	<0.0040	0.205
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	11.4	580	479	21.8	166
	Manganese (Mn)-Total (mg/kg wwt)	1.01	277	500	5.49	65.7
	Mercury (Hg)-Total (mg/kg wwt)	<0.0010	0.0499	0.0095	<0.0010	0.0730
	Molybdenum (Mo)-Total (mg/kg wwt)	<0.0040	0.0673	0.181	<0.0040	0.0137
	Nickel (Ni)-Total (mg/kg wwt)	0.041	1.26	1.74	0.067	0.259
	Phosphorus (P)-Total (mg/kg wwt)	25.5	376	359	42.3	182
	Potassium (K)-Total (mg/kg wwt)	138	1320	3400	289	648
	Rubidium (Rb)-Total (mg/kg wwt)	0.357	2.11	3.00	0.458	0.466
	Selenium (Se)-Total (mg/kg wwt)	<0.010	0.049	0.012	<0.010	0.044
	Sodium (Na)-Total (mg/kg wwt)	<4.0	160	9.8	<4.0	13.0
	Strontium (Sr)-Total (mg/kg wwt)	0.112	8.98	6.38	0.063	2.43
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	<0.00040	0.00442	0.00541	<0.00040	0.00137
	Tin (Sn)-Total (mg/kg wwt)	0.033	<0.020	<0.020	0.032	<0.020
	Uranium (U)-Total (mg/kg wwt)	<0.00040	0.0488	0.00698	<0.00040	0.00496
	Vanadium (V)-Total (mg/kg wwt)	<0.020	0.149	0.050	<0.020	0.048
	Zinc (Zn)-Total (mg/kg wwt)	0.33	21.4	21.4	0.42	7.53
	Zirconium (Zr)-Total (mg/kg wwt)	<0.040	0.167	<0.040	<0.040	0.044

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1661327-15	L1661327-16	L1661327-18	L1661327-19	L1661327-20
Description	Tissue	Tissue	Tissue	Tissue	Tissue
Sampled Date	14-AUG-15	14-AUG-15	14-AUG-15	14-AUG-15	14-AUG-15
Sampled Time					
Client ID	AER-GR-REP2	AER-BER-REP2	AER-LI-REP3	AER-GR-REP3	AER-BER-REP3
Grouping / **Analyte**					
TISSUE					
Physical Tests % Moisture (%)	55.7	83.6	32.1	56.4	81.0
Metals Aluminum (Al)-Total (mg/kg wwt)	12.2	<0.40	27.9	16.7	<0.40
Antimony (Sb)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)-Total (mg/kg wwt)	0.0187	<0.0040	0.0505	0.0250	<0.0040
Barium (Ba)-Total (mg/kg wwt)	13.6	0.259	3.23	22.1	0.289
Beryllium (Be)-Total (mg/kg wwt)	0.0052	<0.0020	<0.0020	0.0081	<0.0020
Bismuth (Bi)-Total (mg/kg wwt)	<0.0020	<0.0020	0.0029	<0.0020	<0.0020
Boron (B)-Total (mg/kg wwt)	1.75	0.24	0.35	2.09	0.24
Cadmium (Cd)-Total (mg/kg wwt)	0.0120	0.0018	0.0456	0.0092	<0.0010
Calcium (Ca)-Total (mg/kg wwt)	1100	33.4	1260	1380	35.2
Cesium (Cs)-Total (mg/kg wwt)	0.0062	<0.0010	0.0071	0.0071	<0.0010
Chromium (Cr)-Total (mg/kg wwt)	0.083	<0.010	0.241	0.076	<0.010
Cobalt (Co)-Total (mg/kg wwt)	0.0435	<0.0040	0.0248	0.0431	<0.0040
Copper (Cu)-Total (mg/kg wwt)	1.41	0.159	0.769	1.37	0.188
Iron (Fe)-Total (mg/kg wwt)	40.2	<0.60	36.1	41.8	<0.60
Lead (Pb)-Total (mg/kg wwt)	0.0387	<0.0040	0.236	0.0269	<0.0040
Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total (mg/kg wwt)	475	18.1	213	605	21.8
Manganese (Mn)-Total (mg/kg wwt)	328	6.16	89.7	227	4.84
Mercury (Hg)-Total (mg/kg wwt)	0.0047	<0.0010	0.0587	0.0042	<0.0010
Molybdenum (Mo)-Total (mg/kg wwt)	0.162	<0.0040	0.0167	0.264	<0.0040
Nickel (Ni)-Total (mg/kg wwt)	1.38	0.069	0.459	1.80	0.066
Phosphorus (P)-Total (mg/kg wwt)	388	36.6	235	302	43.2
Potassium (K)-Total (mg/kg wwt)	3030	239	770	3040	303
Rubidium (Rb)-Total (mg/kg wwt)	1.88	0.233	0.503	1.66	0.311
Selenium (Se)-Total (mg/kg wwt)	<0.010	<0.010	0.042	<0.010	<0.010
Sodium (Na)-Total (mg/kg wwt)	23.0	<4.0	17.7	16.5	<4.0
Strontium (Sr)-Total (mg/kg wwt)	6.61	0.099	3.28	9.50	0.087
Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total (mg/kg wwt)	<0.00040	<0.00040	0.00063	<0.00040	<0.00040
Tin (Sn)-Total (mg/kg wwt)	<0.020	0.024	<0.020	<0.020	0.023
Uranium (U)-Total (mg/kg wwt)	0.0121	<0.00040	0.00549	0.0174	<0.00040
Vanadium (V)-Total (mg/kg wwt)	<0.020	<0.020	0.056	<0.020	<0.020
Zinc (Zn)-Total (mg/kg wwt)	13.5	0.42	9.30	8.47	0.37
Zirconium (Zr)-Total (mg/kg wwt)	<0.040	<0.040	0.042	<0.040	<0.040

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1661327-22	L1661327-23	L1661327-24	L1661327-26	L1661327-27
Description	Tissue	Tissue	Tissue	Tissue	Tissue
Sampled Date	14-AUG-15	14-AUG-15	14-AUG-15	14-AUG-15	14-AUG-15
Sampled Time					
Client ID	AER-LI-REP4	AER-GR-REP4	AER-BER-REP4	AER-LI-REP5	AER-GR-REP5
Grouping / **Analyte**					
TISSUE					
Physical Tests % Moisture (%)	42.0	62.0	84.3	33.2	57.2
Metals Aluminum (Al)-Total (mg/kg wwt)	29.6	25.2	<0.40	39.1	8.95
Antimony (Sb)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)-Total (mg/kg wwt)	0.0401	0.0264	<0.0040	0.0651	0.0194
Barium (Ba)-Total (mg/kg wwt)	3.11	7.08	0.251	5.51	14.7
Beryllium (Be)-Total (mg/kg wwt)	0.0029	0.0035	<0.0020	0.0098	0.0026
Bismuth (Bi)-Total (mg/kg wwt)	0.0057	<0.0020	<0.0020	0.0029	<0.0020
Boron (B)-Total (mg/kg wwt)	0.27	1.10	0.20	0.24	2.06
Cadmium (Cd)-Total (mg/kg wwt)	0.0675	0.0156	0.0017	0.0586	0.0123
Calcium (Ca)-Total (mg/kg wwt)	1980	754	31.0	2010	1190
Cesium (Cs)-Total (mg/kg wwt)	0.0109	0.0038	<0.0010	0.0094	0.0045
Chromium (Cr)-Total (mg/kg wwt)	0.168	0.164	<0.010	0.251	0.126
Cobalt (Co)-Total (mg/kg wwt)	0.0456	0.0560	<0.0040	0.0652	0.0291
Copper (Cu)-Total (mg/kg wwt)	0.626	1.17	0.155	0.612	1.23
Iron (Fe)-Total (mg/kg wwt)	42.5	53.1	0.69	55.8	37.3
Lead (Pb)-Total (mg/kg wwt)	0.250	0.0452	<0.0040	0.304	0.0308
Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total (mg/kg wwt)	204	346	18.2	264	535
Manganese (Mn)-Total (mg/kg wwt)	68.7	257	5.97	44.4	387
Mercury (Hg)-Total (mg/kg wwt)	0.0489	0.0058	<0.0010	0.0681	0.0045
Molybdenum (Mo)-Total (mg/kg wwt)	0.0319	0.205	<0.0040	0.0225	0.150
Nickel (Ni)-Total (mg/kg wwt)	1.13	1.24	0.070	0.685	1.05
Phosphorus (P)-Total (mg/kg wwt)	293	351	37.9	238	346
Potassium (K)-Total (mg/kg wwt)	785	2160	227	676	3130
Rubidium (Rb)-Total (mg/kg wwt)	0.737	0.861	0.226	0.685	1.60
Selenium (Se)-Total (mg/kg wwt)	0.035	0.011	<0.010	0.042	<0.010
Sodium (Na)-Total (mg/kg wwt)	39.1	30.1	<4.0	18.9	20.4
Strontium (Sr)-Total (mg/kg wwt)	5.95	4.62	0.099	8.59	6.79
Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total (mg/kg wwt)	0.00096	0.00056	<0.00040	0.00086	<0.00040
Tin (Sn)-Total (mg/kg wwt)	<0.020	<0.020	<0.020	<0.020	<0.020
Uranium (U)-Total (mg/kg wwt)	0.0179	0.0175	<0.00040	0.0367	0.00267
Vanadium (V)-Total (mg/kg wwt)	0.050	0.039	<0.020	0.059	<0.020
Zinc (Zn)-Total (mg/kg wwt)	9.01	13.8	0.40	8.85	14.6
Zirconium (Zr)-Total (mg/kg wwt)	0.064	<0.040	<0.040	0.068	<0.040

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-28 Tissue 14-AUG-15 AER-BER-REP5	L1661327-30 Tissue 14-AUG-15 AER-LI-04	L1661327-31 Tissue 14-AUG-15 AER-GR-04	L1661327-32 Tissue 14-AUG-15 AER-BER-04	L1661327-34 Tissue 14-AUG-15 AER-LI-05
TISSUE						
Physical Tests	% Moisture (%)	88.1	10.3	43.3	78.3	11.1
Metals	Aluminum (Al)-Total (mg/kg wwt)	<0.40	23.4	31.4	1.07	36.7
	Antimony (Sb)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Arsenic (As)-Total (mg/kg wwt)	<0.0040	0.0521	0.0153	<0.0040	0.0490
	Barium (Ba)-Total (mg/kg wwt)	0.223	3.85	16.5	0.451	18.0
	Beryllium (Be)-Total (mg/kg wwt)	<0.0020	0.0052	0.0067	<0.0020	0.0177
	Bismuth (Bi)-Total (mg/kg wwt)	<0.0020	0.0036	<0.0020	<0.0020	0.0041
	Boron (B)-Total (mg/kg wwt)	<0.20	<0.20	1.10	0.30	0.34
	Cadmium (Cd)-Total (mg/kg wwt)	0.0022	0.0385	0.0099	<0.0010	0.0854
	Calcium (Ca)-Total (mg/kg wwt)	23.8	621	848	57.1	3290
	Cesium (Cs)-Total (mg/kg wwt)	<0.0010	0.0159	0.0151	0.0011	0.0106
	Chromium (Cr)-Total (mg/kg wwt)	<0.010	0.143	0.184	<0.010	0.187
	Cobalt (Co)-Total (mg/kg wwt)	<0.0040	0.0469	0.0628	<0.0040	0.120
	Copper (Cu)-Total (mg/kg wwt)	0.089	0.615	0.862	0.236	0.634
	Iron (Fe)-Total (mg/kg wwt)	<0.60	35.4	46.2	0.79	63.6
	Lead (Pb)-Total (mg/kg wwt)	<0.0040	0.343	0.0912	<0.0040	0.518
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	11.7	125	239	28.2	280
	Manganese (Mn)-Total (mg/kg wwt)	4.64	28.7	96.8	8.95	62.3
	Mercury (Hg)-Total (mg/kg wwt)	<0.0010	0.0651	0.0108	<0.0010	0.0772
	Molybdenum (Mo)-Total (mg/kg wwt)	<0.0040	0.0139	0.163	0.0055	0.0179
	Nickel (Ni)-Total (mg/kg wwt)	0.055	0.141	1.07	<0.040	0.335
	Phosphorus (P)-Total (mg/kg wwt)	25.8	173	382	43.0	287
	Potassium (K)-Total (mg/kg wwt)	129	763	2490	317	1010
	Rubidium (Rb)-Total (mg/kg wwt)	0.122	1.94	3.83	0.694	1.64
	Selenium (Se)-Total (mg/kg wwt)	<0.010	0.049	0.014	<0.010	0.050
	Sodium (Na)-Total (mg/kg wwt)	<4.0	14.3	13.0	<4.0	19.9
	Strontium (Sr)-Total (mg/kg wwt)	0.069	1.96	3.91	0.090	12.0
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	<0.00040	0.00203	0.00131	<0.00040	0.00346
	Tin (Sn)-Total (mg/kg wwt)	0.024	<0.020	<0.020	0.033	<0.020
	Uranium (U)-Total (mg/kg wwt)	<0.00040	0.00560	0.00305	<0.00040	0.0120
	Vanadium (V)-Total (mg/kg wwt)	<0.020	0.046	0.041	<0.020	0.059
	Zinc (Zn)-Total (mg/kg wwt)	0.36	8.36	9.79	0.45	15.6
	Zirconium (Zr)-Total (mg/kg wwt)	<0.040	<0.040	0.111	<0.040	0.060

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-35 Tissue 14-AUG-15 AER-GR-05	L1661327-36 Tissue 14-AUG-15 AER-BER-05	L1661327-38 Tissue 14-AUG-15 AER-LI-06	L1661327-39 Tissue 14-AUG-15 AER-GR-06	L1661327-40 Tissue 14-AUG-15 AER-BER-06
TISSUE						
Physical Tests	% Moisture (%)	47.5	86.1	10.1	45.6	85.0
Metals	Aluminum (Al)-Total (mg/kg wwt)	47.3	0.81	39.7	17.4	<0.40
	Antimony (Sb)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Arsenic (As)-Total (mg/kg wwt)	0.0278	<0.0040	0.0708	0.0161	<0.0040
	Barium (Ba)-Total (mg/kg wwt)	16.9	0.258	8.32	62.1	0.304
	Beryllium (Be)-Total (mg/kg wwt)	0.0088	<0.0020	0.0053	0.0146	<0.0020
	Bismuth (Bi)-Total (mg/kg wwt)	<0.0020	<0.0020	0.0036	<0.0020	<0.0020
	Boron (B)-Total (mg/kg wwt)	0.89	<0.20	0.21	2.11	0.23
	Cadmium (Cd)-Total (mg/kg wwt)	0.0119	0.0015	0.0409	0.0098	0.0021
	Calcium (Ca)-Total (mg/kg wwt)	860	30.4	909	1860	34.6
	Cesium (Cs)-Total (mg/kg wwt)	0.0145	<0.0010	0.0201	0.0086	<0.0010
	Chromium (Cr)-Total (mg/kg wwt)	0.313	<0.010	0.375	0.124	<0.010
	Cobalt (Co)-Total (mg/kg wwt)	0.0721	<0.0040	0.0820	0.0681	<0.0040
	Copper (Cu)-Total (mg/kg wwt)	0.809	0.061	0.624	2.11	0.117
	Iron (Fe)-Total (mg/kg wwt)	81.5	0.99	69.5	95.5	<0.60
	Lead (Pb)-Total (mg/kg wwt)	0.141	<0.0040	0.316	0.0614	<0.0040
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	263	14.3	220	453	17.4
	Manganese (Mn)-Total (mg/kg wwt)	99.9	0.743	90.3	388	7.48
	Mercury (Hg)-Total (mg/kg wwt)	0.0123	<0.0010	0.0673	0.0068	<0.0010
	Molybdenum (Mo)-Total (mg/kg wwt)	0.0720	<0.0040	0.0247	2.99	<0.0040
	Nickel (Ni)-Total (mg/kg wwt)	0.631	<0.040	0.282	1.67	<0.040
	Phosphorus (P)-Total (mg/kg wwt)	341	23.6	226	700	31.5
	Potassium (K)-Total (mg/kg wwt)	1980	162	857	3860	190
	Rubidium (Rb)-Total (mg/kg wwt)	3.26	0.320	1.40	3.00	0.269
	Selenium (Se)-Total (mg/kg wwt)	0.016	<0.010	0.042	0.011	<0.010
	Sodium (Na)-Total (mg/kg wwt)	10.7	<4.0	24.4	12.6	<4.0
	Strontium (Sr)-Total (mg/kg wwt)	5.13	0.082	4.57	17.6	0.078
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	0.0081	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	0.00124	<0.00040	0.00271	<0.00040	<0.00040
	Tin (Sn)-Total (mg/kg wwt)	<0.020	0.040	<0.020	<0.020	0.038
	Uranium (U)-Total (mg/kg wwt)	0.00687	<0.00040	0.00670	0.00200	<0.00040
	Vanadium (V)-Total (mg/kg wwt)	0.072	<0.020	0.080	0.025	<0.020
	Zinc (Zn)-Total (mg/kg wwt)	12.6	0.35	11.6	15.4	0.45
	Zirconium (Zr)-Total (mg/kg wwt)	0.053	<0.040	0.050	<0.040	<0.040

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-42 Tissue 14-AUG-15 AER-LI-07	L1661327-43 Tissue 14-AUG-15 AER-GR-07	L1661327-44 Tissue 14-AUG-15 AER-BER-07	L1661327-46 Tissue 15-AUG-15 AER-LI-08	L1661327-47 Tissue 15-AUG-15 AER-GR-08
TISSUE						
Physical Tests	% Moisture (%)	10.6	46.1	87.3	15.7	36.5
Metals	Aluminum (Al)-Total (mg/kg wwt)	228	22.6	0.84	31.6	72.2
	Antimony (Sb)-Total (mg/kg wwt)	0.0055	<0.0020	<0.0020	<0.0020	0.0026
	Arsenic (As)-Total (mg/kg wwt)	0.149	0.0196	<0.0040	0.0832	0.0757
	Barium (Ba)-Total (mg/kg wwt)	15.7	15.9	0.236	3.42	29.8
	Beryllium (Be)-Total (mg/kg wwt)	0.0170	0.0045	<0.0020	0.0023	0.0067
	Bismuth (Bi)-Total (mg/kg wwt)	0.0130	0.0020	<0.0020	0.0055	0.0024
	Boron (B)-Total (mg/kg wwt)	0.42	1.20	<0.20	0.24	1.88
	Cadmium (Cd)-Total (mg/kg wwt)	0.0697	0.0070	0.0019	0.0477	0.0168
	Calcium (Ca)-Total (mg/kg wwt)	780	860	24.9	460	1430
	Cesium (Cs)-Total (mg/kg wwt)	0.0383	0.0226	<0.0010	0.0155	0.0128
	Chromium (Cr)-Total (mg/kg wwt)	0.659	0.191	<0.010	0.214	0.366
	Cobalt (Co)-Total (mg/kg wwt)	0.251	0.0534	<0.0040	0.0350	0.131
	Copper (Cu)-Total (mg/kg wwt)	1.14	0.906	0.053	0.613	1.20
	Iron (Fe)-Total (mg/kg wwt)	367	44.6	0.91	46.1	117
	Lead (Pb)-Total (mg/kg wwt)	1.17	0.0709	<0.0040	0.383	0.196
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	261	308	9.56	135	415
	Manganese (Mn)-Total (mg/kg wwt)	48.4	54.0	0.962	53.6	214
	Mercury (Hg)-Total (mg/kg wwt)	0.139	0.0083	<0.0010	0.0914	0.0164
	Molybdenum (Mo)-Total (mg/kg wwt)	0.0237	0.146	<0.0040	0.0149	0.321
	Nickel (Ni)-Total (mg/kg wwt)	0.696	1.23	<0.040	0.234	1.44
	Phosphorus (P)-Total (mg/kg wwt)	249	344	20.2	173	449
	Potassium (K)-Total (mg/kg wwt)	739	2700	140	603	3210
	Rubidium (Rb)-Total (mg/kg wwt)	1.86	4.55	0.466	1.61	3.73
	Selenium (Se)-Total (mg/kg wwt)	0.072	0.010	<0.010	0.052	0.021
	Sodium (Na)-Total (mg/kg wwt)	16.7	10.4	<4.0	10.4	17.1
	Strontium (Sr)-Total (mg/kg wwt)	3.83	3.81	0.075	1.24	6.76
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	0.00620	0.00706	<0.00040	0.00322	0.00348
	Tin (Sn)-Total (mg/kg wwt)	0.021	<0.020	<0.020	<0.020	<0.020
	Uranium (U)-Total (mg/kg wwt)	0.0758	0.00242	<0.00040	0.00696	0.0128
	Vanadium (V)-Total (mg/kg wwt)	0.323	0.036	<0.020	0.073	0.128
	Zinc (Zn)-Total (mg/kg wwt)	11.9	10.9	0.26	6.08	23.8
	Zirconium (Zr)-Total (mg/kg wwt)	0.202	<0.040	<0.040	0.064	0.079

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-48 Tissue 15-AUG-15 AER-BER-08	L1661327-50 Tissue 15-AUG-15 AER-LI-08-DUP	L1661327-51 Tissue 15-AUG-15 AER-GR-08-DUP	L1661327-52 Tissue 15-AUG-15 AER-BER-08-DUP	L1661327-54 Tissue 15-AUG-15 AER-LI-09
TISSUE						
Physical Tests	% Moisture (%)	79.8	15.2	46.5	81.8	13.9
Metals	Aluminum (Al)-Total (mg/kg wwt)	<0.40	147	26.8	<0.40	35.8
	Antimony (Sb)-Total (mg/kg wwt)	<0.0020	0.0064	0.0054	<0.0020	0.0078
	Arsenic (As)-Total (mg/kg wwt)	<0.0040	0.173	0.0430	<0.0040	0.0609
	Barium (Ba)-Total (mg/kg wwt)	0.309	9.26	23.6	0.295	8.74
	Beryllium (Be)-Total (mg/kg wwt)	<0.0020	0.0065	0.0049	<0.0020	0.0052
	Bismuth (Bi)-Total (mg/kg wwt)	<0.0020	0.0120	0.0044	<0.0020	0.0062
	Boron (B)-Total (mg/kg wwt)	0.28	0.31	1.04	0.27	0.53
	Cadmium (Cd)-Total (mg/kg wwt)	<0.0010	0.0482	0.0102	<0.0010	0.0324
	Calcium (Ca)-Total (mg/kg wwt)	32.4	407	760	31.6	508
	Cesium (Cs)-Total (mg/kg wwt)	<0.0010	0.0337	0.0075	<0.0010	0.0268
	Chromium (Cr)-Total (mg/kg wwt)	<0.010	0.560	0.171	<0.010	0.188
	Cobalt (Co)-Total (mg/kg wwt)	<0.0040	0.113	0.0708	<0.0040	0.0440
	Copper (Cu)-Total (mg/kg wwt)	0.194	0.782	0.848	0.182	0.822
	Iron (Fe)-Total (mg/kg wwt)	<0.60	233	43.9	<0.60	45.2
	Lead (Pb)-Total (mg/kg wwt)	<0.0040	1.32	0.0835	<0.0040	0.241
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	20.6	167	265	19.4	185
	Manganese (Mn)-Total (mg/kg wwt)	3.08	34.4	87.9	2.93	57.6
	Mercury (Hg)-Total (mg/kg wwt)	<0.0010	0.149	0.0103	<0.0010	0.128
	Molybdenum (Mo)-Total (mg/kg wwt)	<0.0040	0.0214	0.211	<0.0040	0.0162
	Nickel (Ni)-Total (mg/kg wwt)	0.042	1.07	1.07	0.041	0.555
	Phosphorus (P)-Total (mg/kg wwt)	41.6	169	266	38.5	313
	Potassium (K)-Total (mg/kg wwt)	311	596	2310	290	872
	Rubidium (Rb)-Total (mg/kg wwt)	0.578	2.12	2.98	0.544	2.62
	Selenium (Se)-Total (mg/kg wwt)	<0.010	0.075	0.014	<0.010	0.066
	Sodium (Na)-Total (mg/kg wwt)	<4.0	25.3	12.3	<4.0	14.9
	Strontium (Sr)-Total (mg/kg wwt)	0.077	1.54	4.79	0.076	1.34
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	<0.00040	0.00748	0.00423	<0.00040	0.00288
	Tin (Sn)-Total (mg/kg wwt)	0.022	0.021	<0.020	0.021	<0.020
	Uranium (U)-Total (mg/kg wwt)	<0.00040	0.0184	0.00275	<0.00040	0.00524
	Vanadium (V)-Total (mg/kg wwt)	<0.020	0.306	0.038	<0.020	0.065
	Zinc (Zn)-Total (mg/kg wwt)	0.30	8.02	11.0	0.28	9.71
	Zirconium (Zr)-Total (mg/kg wwt)	<0.040	0.133	<0.040	<0.040	0.051

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1661327-55 Tissue 15-AUG-15 AER-GR-09	L1661327-56 Tissue 15-AUG-15 AER-BER-09	L1661327-58 Tissue 15-AUG-15 AER-LI-10	L1661327-59 Tissue 15-AUG-15 AER-GR-10	L1661327-60 Tissue 15-AUG-15 AER-BER-10
TISSUE						
Physical Tests	% Moisture (%)	44.5	75.5	11.2	36.1	83.8
Metals	Aluminum (Al)-Total (mg/kg wwt)	13.3	1.47	353	51.1	<0.40
	Antimony (Sb)-Total (mg/kg wwt)	0.0039	<0.0020	0.0118	0.0460	<0.0020
	Arsenic (As)-Total (mg/kg wwt)	0.0220	<0.0040	0.178	0.0981	<0.0040
	Barium (Ba)-Total (mg/kg wwt)	45.0	0.637	18.4	17.2	0.228
	Beryllium (Be)-Total (mg/kg wwt)	0.0038	<0.0020	0.0307	0.0109	<0.0020
	Bismuth (Bi)-Total (mg/kg wwt)	<0.0020	<0.0020	0.0250	0.0552	<0.0020
	Boron (B)-Total (mg/kg wwt)	3.10	0.44	0.66	2.00	<0.20
	Cadmium (Cd)-Total (mg/kg wwt)	0.0111	<0.0010	0.154	0.0283	<0.0010
	Calcium (Ca)-Total (mg/kg wwt)	1010	58.2	2760	1360	27.4
	Cesium (Cs)-Total (mg/kg wwt)	0.0260	<0.0010	0.0553	0.0300	<0.0010
	Chromium (Cr)-Total (mg/kg wwt)	0.080	<0.010	0.811	0.466	<0.010
	Cobalt (Co)-Total (mg/kg wwt)	0.0877	<0.0040	0.180	0.0883	<0.0040
	Copper (Cu)-Total (mg/kg wwt)	1.80	0.275	1.75	1.98	0.147
	Iron (Fe)-Total (mg/kg wwt)	30.7	1.66	492	110	<0.60
	Lead (Pb)-Total (mg/kg wwt)	0.0437	<0.0040	3.15	0.432	<0.0040
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	0.10	<0.10	<0.10
	Magnesium (Mg)-Total (mg/kg wwt)	601	34.1	240	357	14.9
	Manganese (Mn)-Total (mg/kg wwt)	136	8.19	42.8	69.7	4.17
	Mercury (Hg)-Total (mg/kg wwt)	0.0106	<0.0010	0.120	0.0180	<0.0010
	Molybdenum (Mo)-Total (mg/kg wwt)	0.433	<0.0040	0.0837	0.414	<0.0040
	Nickel (Ni)-Total (mg/kg wwt)	3.40	0.059	1.28	1.23	<0.040
	Phosphorus (P)-Total (mg/kg wwt)	595	61.9	329	379	27.2
	Potassium (K)-Total (mg/kg wwt)	3480	428	904	3210	230
	Rubidium (Rb)-Total (mg/kg wwt)	5.71	0.684	3.58	8.34	0.498
	Selenium (Se)-Total (mg/kg wwt)	<0.010	<0.010	0.118	0.069	<0.010
	Sodium (Na)-Total (mg/kg wwt)	20.2	<4.0	26.8	14.6	<4.0
	Strontium (Sr)-Total (mg/kg wwt)	9.77	0.133	6.12	4.19	0.037
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	0.0060	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	0.00135	<0.00040	0.00995	0.0531	<0.00040
	Tin (Sn)-Total (mg/kg wwt)	<0.020	0.025	0.040	0.025	<0.020
	Uranium (U)-Total (mg/kg wwt)	0.00134	<0.00040	0.633	0.00967	<0.00040
	Vanadium (V)-Total (mg/kg wwt)	0.020	<0.020	0.474	0.112	<0.020
	Zinc (Zn)-Total (mg/kg wwt)	17.0	0.49	18.8	14.7	0.28
	Zirconium (Zr)-Total (mg/kg wwt)	<0.040	<0.040	0.405	0.053	<0.040

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1661327-62	L1661327-63	L1661327-64		
	Description	Tissue	Tissue	Tissue		
	Sampled Date	14-AUG-15	14-AUG-15	14-AUG-15		
	Sampled Time					
	Client ID	AER-LI-REP1	AER-GR-REP1	AER-BER-REP1		
Grouping	**Analyte**					
TISSUE						
Physical Tests	% Moisture (%)	81.0	57.1	81.4		
Metals	Aluminum (Al)-Total (mg/kg wwt)	72.1	8.66	<0.40		
	Antimony (Sb)-Total (mg/kg wwt)	0.0056	<0.0020	<0.0020		
	Arsenic (As)-Total (mg/kg wwt)	0.0353	0.0262	<0.0040		
	Barium (Ba)-Total (mg/kg wwt)	9.55	15.3	0.250		
	Beryllium (Be)-Total (mg/kg wwt)	0.0254	0.0032	<0.0020		
	Bismuth (Bi)-Total (mg/kg wwt)	0.0022	<0.0020	<0.0020		
	Boron (B)-Total (mg/kg wwt)	0.35	1.54	0.25		
	Cadmium (Cd)-Total (mg/kg wwt)	0.0260	0.0093	0.0013		
	Calcium (Ca)-Total (mg/kg wwt)	1080	948	39.0		
	Cesium (Cs)-Total (mg/kg wwt)	0.0041	0.0076	<0.0010		
	Chromium (Cr)-Total (mg/kg wwt)	0.216	0.097	<0.010		
	Cobalt (Co)-Total (mg/kg wwt)	0.0559	0.0360	<0.0040		
	Copper (Cu)-Total (mg/kg wwt)	0.741	1.33	0.234		
	Iron (Fe)-Total (mg/kg wwt)	86.3	39.5	0.85		
	Lead (Pb)-Total (mg/kg wwt)	0.0680	0.0290	<0.0040		
	Lithium (Li)-Total (mg/kg wwt)	<0.10	<0.10	<0.10		
	Magnesium (Mg)-Total (mg/kg wwt)	387	598	24.3		
	Manganese (Mn)-Total (mg/kg wwt)	36.5	221	6.10		
	Mercury (Hg)-Total (mg/kg wwt)	0.0114	0.0051	<0.0010		
	Molybdenum (Mo)-Total (mg/kg wwt)	0.0195	0.209	<0.0040		
	Nickel (Ni)-Total (mg/kg wwt)	2.44	1.47	0.066		
	Phosphorus (P)-Total (mg/kg wwt)	96.2	541	56.6		
	Potassium (K)-Total (mg/kg wwt)	359	4800	301		
	Rubidium (Rb)-Total (mg/kg wwt)	0.290	2.97	0.328		
	Selenium (Se)-Total (mg/kg wwt)	0.012	<0.010	<0.010		
	Sodium (Na)-Total (mg/kg wwt)	15.0	17.8	<4.0		
	Strontium (Sr)-Total (mg/kg wwt)	8.83	6.47	0.127		
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040		
	Thallium (Tl)-Total (mg/kg wwt)	0.00081	0.00057	<0.00040		
	Tin (Sn)-Total (mg/kg wwt)	<0.020	<0.020	0.026		
	Uranium (U)-Total (mg/kg wwt)	0.126	0.00893	<0.00040		
	Vanadium (V)-Total (mg/kg wwt)	0.081	<0.020	<0.020		
	Zinc (Zn)-Total (mg/kg wwt)	5.56	11.5	0.59		
	Zirconium (Zr)-Total (mg/kg wwt)	0.080	<0.040	<0.040		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aluminum (Al)-Total	DUP-H	L1661327-12, -16, -20, -24, -28, -32, -36, -4, -40, -44, -48, -50, -51, -52, -54, -55, -56, -58, -59, -60, -62, -63, -64, -8
Duplicate	Iron (Fe)-Total	DUP-H	L1661327-12, -16, -20, -24, -28, -32, -36, -4, -40, -44, -48, -50, -51, -52, -54, -55, -56, -58, -59, -60, -62, -63, -64, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

HG-WET-CVAFS-N-VA	Tissue	Mercury in Tissue by CVAFS (WET)	EPA 200.3, EPA 245.7

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7.

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

MET-WET-CCMS-N-VA	Tissue	Metals in Tissue by CRC ICPMS (WET)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

MOISTURE-TISS-VA	Tissue	% Moisture in Tissues	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

L1661327-COFC

COC # _____

Page 1 of _____

Report To				Service Requested (Rush for routine analysis subject to availability)
Company:	Agnico Eagle Mines Ltd.-Meadowbank Division	☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Ryan VanEngen	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	Baker Lake NU X0C 0A0	Email 1: ryan.vanengen@agnicoeagle.com		○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
		Email 2: andrea_amendola@golder.com		○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	819 651 2974 Fax:	Email 3: leilan.baxter@agnicoeagle.com		
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: Meadowbank SLRA		Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #: 52390		
Lab Work Order # (lab use only)		ALS Contact: Ariel Tang	Sampler: David Brown	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Met+Hg+pH (MET-CCME+FUL	Metals (MET-WET-CCMS-N-VA	Moisture (MOISTURE-TISS-VA	Mercury (HG-WET-CVAFS-N-V	Number of Containers
1	AER-SOIL-01	Aug 14/15	—	Soil	X				1
2	lichen- AER-LI-01		—	Tissue		X	X	X	1
3	~~sedge~~ AER-GR-01		—	Tissue		X	X	X	1
4	~~berries~~ AER-BER-01		—	Tissue		X	X	X	1
5	AER-SOIL-02		—	Soil	X				1
6	AER-LI-02		—	Tissue		X	X	X	1
7	AER-GR-02		—	Tissue		X	X	X	1
8	AER-BER-02		—	Tissue		X	X	X	1
9	AER-SOIL-03		—	Soil	X				1
10	AER-LI-03		—	Tissue		X	X	X	1
11	AER-GR-03		—	Tissue		X	X	X	1
12	AER-BER-03		—	Tissue		X	X	X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Please see back side of 1st sheet for more sample ID's & analysis → Contact David Brown djbrown@golder.com if questions ~~arise~~ arise

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh:mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			CC	21 Aug 15	12:05	°C				

GENF 20.00 Front

	SAMPLE ID	DATE	SAMPLE TYPE	ANALYSIS
13	AER-SOIL-REP2	Aug 14/15	SOIL	
14	AER-LI-REP2		TISSUE	
15	AER-GR-REP2		TISSUE	
16	AER-BER-REP2		TISSUE	
17	AER-SOIL-REP3		SOIL	
18	AER-LI-REP3		TISSUE	
19	AER-GR-REP3		TISSUE	
20	AER-BER-REP3		TISSUE	
21	AER-SOIL-REP4		SOIL	
22	AER-LI-REP4		TISSUE	
23	AER-GR-REP4		TISSUE	
24	AER-BER-REP4		TISSUE	
25	AER-SOIL-REP5		SOIL	
26	AER-LI-REP5		TISSUE	
27	AER-GR-REP5		TISSUE	
28	AER-BER-REP5		TISSUE	

L1661327-COFC

See other side of COC.

ALS Environmental

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COC # _____

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Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Agnico Eagle Mines Ltd.-Meadowbank Division	☐ Standard ☑ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Ryan VanEngen	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	Baker Lake NU X0C 0A0	Email 1:	ryan.vanengen@agnicoeagle.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
		Email 2:	andrea_amendola@golder.com	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	819 651 2974 Fax:	Email 3:	leilan.baxter@agnicoeagle.com	
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank SLRA	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	52390	
Lab Work Order # (lab use only)		ALS Contact:	Ariel Tang	Sampler: David Brown

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Met+Hg+pH (MET-CCME+FUL	Metals (MET-WET-CCMS-N-VA	Moisture (MOISTURE-TISS-VA	Mercury (HG-WET-CVAFS-N-V									Number of Containers
29	AER-SOIL-04	Aug 14/15	—	Soil	X												1
30	~~lichen~~ AER-LI-04		—	Tissue		X	X	X									1
31	~~sedge~~ AER-GR-04		—	Tissue		X	X	X									1
32	~~berries~~ AER-BER-04		—	Tissue		X	X	X									1
33	AER-SOIL-05		—	Soil	X												1
34	AER-LI-05		—	Tissue		X	X	X									1
35	AER-GR-05		—	Tissue		X	X	X									1
36	AER-BER-05		—	Tissue		X	X	X									1
37	AER-SOIL-06		—	Soil	X												1
38	AER-LI-06		—	Tissue		X	X	X									1
39	AER-GR-06		—	Tissue		X	X	X									1
40	AER-BER-06		—	Tissue		X	X	X									1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Environmental

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COC # _____

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Report To					
Company:	Agnico Eagle Mines Ltd.-Meadowbank Division	☐ Standard	☑ Other		
Contact:	Ryan VanEngen	☑ PDF	☑ Excel	☐ Digital	☐ Fax
Address:	Baker Lake NU X0C 0A0	Email 1:	ryan.vanengen@agnicoeagle.com		
		Email 2:	andrea_amendola@golder.com		
Phone:	819 651 2974 Fax:	Email 3:	leilan.baxter@agnicoeagle.com		
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**			
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank SLRA		
Company:		PO / AFE:			
Contact:		LSD:			
Address:					
Phone:	Fax:	Quote #:	52390		
Lab Work Order # (lab use only)		**ALS Contact:**	Ariel Tang	**Sampler:**	David Brown

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Met+Hg+pH (MET-CCME+FUL	Metals (MET-WET-CCMS-N-VA	Moisture (MOISTURE-TISS-VA	Mercury (HG-WET-CVAFS-N-V	Number of Containers
41	AER-SOIL-07	AUG 14/15	—	Soil	X				1
42	~~lichen~~ AER-LI-07		—	Tissue		X	X	X	1
43	~~sedge~~ AER-GR-07		—	Tissue		X	X	X	1
44	~~berries~~ AER-BER-07		—	Tissue		X	X	X	1
45	AER-SOIL-08	Aug 15/15	—	Soil	X				1
46	AER-LI-08		—	Tissue		X	X	X	1
47	AER-GR-08		—	Tissue		X	X	X	1
48	AER-BER-08		—	Tissue		X	X	X	1
49	AER-SOIL-08-DUP		—	Soil	X				1
50	AER-LI-08-DUP		—	Tissue		X	X	X	1
51	AER-GR-08-DUP		—	Tissue		X	X	X	1
52	AER-BER-08-DUP		—	Tissue		X	X	X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

ALS Environmental

L1661327-COFC

COC # _____

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Report To					
Company:	Agnico Eagle Mines Ltd.-Meadowbank Division	☑ PDF	☑ Excel	☐ Digital	☐ Fax
Contact:	Ryan VanEngen	Email 1:	ryan.vanengen@agnicoeagle.com		
Address:	Baker Lake NU X0C 0A0	Email 2:	andrea_amendola@golder.com		
		Email 3:	leilan.baxter@agnicoeagle.com		
Phone:	819 651 2974 Fax:				
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information			
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank SLRA		
Company:		PO / AFE:			
Contact:		LSD:			
Address:					
Phone:	Fax:	Quote #:	52390		
Lab Work Order # (lab use only)		ALS Contact:	Ariel Tang	Sampler:	David Brown

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Met+Hg+pH (MET-CCME+FUL	Metals (MET-WET-CCMS-N-VA	Moisture (MOISTURE-TISS-VA	Mercury (HG-WET-CVAFS-N-V	Number of Containers
53	AER-SOIL-09	Aug 15/15	—	Soil	X				1
54	~~lichen~~ AER-LI-09		—	Tissue		X	X	X	1
55	~~sedge~~ AER-GR-09		—	Tissue		X	X	X	1
56	~~berries~~ AER-BER-09		—	Tissue		X	X	X	1
57	AER-SOIL-10		—	Soil	X				1
58	AER-LI-10		—	Tissue		X	X	X	1
59	AER-GR-10		—	Tissue		X	X	X	1
60	AER-BER-10		—	Tissue		X	X	X	1
61	AER-SOIL-REP1	Aug 14/15	—	Soil	X				1
62	AER-LI-REP1		—	Tissue		X	X	X	1
63	AER-GR-REP1		—	Tissue		X	X	X	1
64	AER-BER-REP1		—	Tissue		X	X	X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

ANNEX A-2

Results of the Soil and Sediment Program

Table 1. Baseline Soil Analytical Results

Sample Location		AER-01	AER-02	AER-03	AER-04	AER-05	AER-06	AER-07	AER-08		AER-09	AER-10	AER-REP						
Sample Name		AER-SOIL-01	AER-SOIL-02	AER-SOIL-03	AER-SOIL-04	AER-SOIL-05	AER-SOIL-06	AER-SOIL-07	AER-SOIL-08	AER-SOIL-08-DUP	AER-SOIL-09	AER-SOIL-10	AER-SOIL-REP1	AER-SOIL-REP2	AER-SOIL-REP3	AER-SOIL-REP4	AER-SOIL-REP5	MIN	MAX
Sampling Date		14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15		
Parameter	**Units**																		
pH (1:2 soil:water)		5.17	4.92	5.41	5.62	5.05	5.25	4.98	5.26	5.62	5.69	4.59	5.68	5.37	5.67	5.47	5.64	4.59	5.69
Aluminum (Al)	mg/kg	9150	6270	6030	7190	6300	7310	6390	7190	8370	9360	8450	9350	6200	9960	6140	8860	6030	9960
Antimony (Sb)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	8.23	3.39	2.87	2.45	2.04	2.72	3.48	12.2	12.9	8	4.94	5.13	4.41	5.66	3.26	4.14	2.04	12.9
Barium (Ba)	mg/kg	14.1	21.9	19.5	39.7	28.2	32.8	21.2	73.9	86.8	48.4	14.3	39.2	21.6	46.5	22.3	32.9	14.1	86.8
Beryllium (Be)	mg/kg	0.22	0.29	0.28	0.4	0.36	0.43	0.31	0.36	0.4	0.35	0.26	0.53	0.33	0.54	0.28	0.44	0.22	0.54
Bismuth (Bi)	mg/kg	<0.20	<0.20	<0.20	0.2	0.21	0.3	<0.20	<0.20	<0.20	<0.20	<0.20	0.25	<0.20	0.27	<0.20	0.22	0.2	0.3
Boron (B)	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium (Cd)	mg/kg	0.061	0.047	0.026	0.032	0.037	0.035	0.045	0.041	0.042	0.038	0.031	0.037	0.036	0.047	0.031	0.043	0.026	0.061
Calcium (Ca)	mg/kg	1550	1970	2680	3070	2020	3170	1540	3150	3620	3280	1130	3430	2650	3110	2670	3440	1130	3620
Chromium (Cr)	mg/kg	140	27.2	44.3	14.9	14.1	19.8	29.2	45.9	55.1	94.1	70	36.7	23.3	38.7	23.5	32.7	14.1	140
Cobalt (Co)	mg/kg	11.6	4.49	4.2	4.98	4.08	4.74	4.27	7.34	8.07	9.1	6.34	9.01	5.49	7.96	4.82	7.25	4.08	11.6
Copper (Cu)	mg/kg	5.5	4.34	4.99	4.44	3.45	10.1	3.47	6.55	7.91	9.71	2.94	7.39	4.76	8.02	4.73	6.03	2.94	10.1
Iron (Fe)	mg/kg	21200	14800	13600	16900	15100	16600	15800	16300	18300	20900	19400	21200	17800	21500	14000	19300	13600	21500
Lead (Pb)	mg/kg	5.16	5.86	5.1	4.95	5.7	7.92	6.77	6.11	6.86	4.72	4.6	7.37	5.71	7.46	5.19	6.78	4.6	7.92
Lithium (Li)	mg/kg	11.3	6.4	7.5	8.2	7.2	8.1	7.7	8.7	10.4	10.7	9.3	10.7	7.4	11.7	6.7	10.1	6.4	11.7
Magnesium (Mg)	mg/kg	8810	3210	3640	3550	2920	3440	3250	4930	5850	6710	5870	4990	3520	5210	3300	4650	2920	8810
Manganese (Mn)	mg/kg	450	185	147	242	202	199	169	264	280	246	196	421	206	310	168	279	147	450
Mercury (Hg)	mg/kg	0.0119	0.0184	<0.0050	0.0057	0.0131	0.0069	0.016	0.0249	0.0089	0.0055	0.0061	0.0084	<0.0050	0.0107	<0.0050	0.0078	0.0055	0.0249
Molybdenum (Mo)	mg/kg	0.43	0.47	0.25	0.27	0.26	0.32	0.28	0.32	0.33	0.29	0.33	0.44	0.32	0.51	0.31	0.41	0.25	0.51
Nickel (Ni)	mg/kg	62.9	14.3	17.7	9.05	7.87	10.6	11	23.5	27.3	38.7	33.1	23.6	14.9	24.5	15.8	19.9	7.87	62.9
Phosphorus (P)	mg/kg	328	325	487	520	361	551	358	735	859	755	232	436	615	479	455	507	232	859
Potassium (K)	mg/kg	630	670	650	710	690	830	710	1480	1890	1540	580	1110	740	1230	730	1060	580	1890
Selenium (Se)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	mg/kg	<50	75	<50	74	68	70	53	66	85	55	<50	113	52	66	<50	63	52	113
Strontium (Sr)	mg/kg	19.1	21.3	26	31.8	21.7	36.7	12.7	36.6	42.6	30	21.1	37.6	24.5	32.4	29.3	37.8	12.7	42.6
Thallium (Tl)	mg/kg	<0.050	0.06	0.052	<0.050	0.053	0.063	0.053	0.093	0.114	0.087	<0.050	0.091	0.056	0.102	0.052	0.081	0.052	0.114
Tin (Sn)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg	374	535	583	698	590	694	572	683	798	716	304	816	491	754	600	740	304	816
Uranium (U)	mg/kg	0.9	1.99	1.8	1.47	1.26	1.92	0.962	1.36	1.56	1.3	0.977	3.08	2.17	2.77	1.75	2.43	0.9	3.08
Vanadium (V)	mg/kg	24	12.4	13	17.4	13.3	15.2	17	20.1	23	25	18.8	17.4	12.2	17.6	11.8	16.7	11.8	25
Zinc (Zn)	mg/kg	36.5	25.5	23.4	29.2	27.7	31.7	25.4	27.6	31.5	30.1	27.8	36.8	28.9	41.4	25.5	36.2	23.4	41.4
Zirconium (Zr)	mg/kg	<1.0	1.6	7	7.1	1.9	7.3	1.8	2.6	4.6	6.9	1.2	4.7	6.9	4.7	5.9	4.7	1.2	7.3

mg/kg = milligram per kilogram; < = less than laboratory method detection limit

Table 2. Baseline Lichen Analytical Results

	Sample Location	AER-01	AER-02	AER-03	AER-04	AER-05	AER-06	AER-07	AER-08		AER-09	AER-10	AER-REP						
	Sample Name	AER-LI-01	AER-LI-02	AER-LI-03	AER-LI-04	AER-LI-05	AER-LI-06	AER-LI-07	AER-LI-08	AER-LI-08-DUP	AER-LI-09	AER-LI-10	AER-LI-REP1	AER-LI-REP2	AER-LI-REP3	AER-LI-REP4	AER-LI-REP5		
	Sampling Date	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15		
Parameter	**Units**																	**MIN**	**MAX**
% Moisture	%	15	12.5	11.3	10.3	11.1	10.1	10.6	15.7	15.2	13.9	11.2	81	25.5	32.1	42	33.2	10.1	81
Aluminum (Al)-Total	mg/kg wwt	55.1	33.1	89.6	23.4	36.7	39.7	228	31.6	147	35.8	353	72.1	23.4	27.9	29.6	39.1	23.4	353
Antimony (Sb)-Total	mg/kg wwt	0.0021	0.0022	0.0045	<0.0020	<0.0020	<0.0020	0.0055	<0.0020	0.0064	0.0078	0.0118	0.0056	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	0.0118
Arsenic (As)-Total	mg/kg wwt	0.0636	0.0454	0.0923	0.0521	0.049	0.0708	0.149	0.0832	0.173	0.0609	0.178	0.0353	0.0444	0.0505	0.0401	0.0651	0.0353	0.178
Barium (Ba)-Total	mg/kg wwt	5.43	7.87	12.6	3.85	18	8.32	15.7	3.42	9.26	8.74	18.4	9.55	3.61	3.23	3.11	5.51	3.11	18.4
Beryllium (Be)-Total	mg/kg wwt	0.0037	0.0065	0.0123	0.0052	0.0177	0.0053	0.017	0.0023	0.0065	0.0052	0.0307	0.0254	<0.0020	<0.0020	0.0029	0.0098	0.0023	0.0307
Bismuth (Bi)-Total	mg/kg wwt	0.003	0.0026	0.0044	0.0036	0.0041	0.0036	0.013	0.0055	0.012	0.0062	0.025	0.0022	0.0032	0.0029	0.0057	0.0029	0.0022	0.025
Boron (B)-Total	mg/kg wwt	0.25	0.31	0.66	<0.20	0.34	0.21	0.42	0.24	0.31	0.53	0.66	0.35	0.25	0.35	0.27	0.24	0.21	0.66
Cadmium (Cd)-Total	mg/kg wwt	0.0387	0.0398	0.0555	0.0385	0.0854	0.0409	0.0697	0.0477	0.0482	0.0324	0.154	0.026	0.0358	0.0456	0.0675	0.0586	0.026	0.154
Calcium (Ca)-Total	mg/kg wwt	770	1030	2330	621	3290	909	780	460	407	508	2760	1080	745	1260	1980	2010	407	3290
Cesium (Cs)-Total	mg/kg wwt	0.0122	0.0169	0.0249	0.0159	0.0106	0.0201	0.0383	0.0155	0.0337	0.0268	0.0553	0.0041	0.0076	0.0071	0.0109	0.0094	0.0041	0.0553
Chromium (Cr)-Total	mg/kg wwt	0.47	0.18	0.715	0.143	0.187	0.375	0.659	0.214	0.56	0.188	0.811	0.216	0.187	0.241	0.168	0.251	0.143	0.811
Cobalt (Co)-Total	mg/kg wwt	0.18	0.0808	0.287	0.0469	0.12	0.082	0.251	0.035	0.113	0.044	0.18	0.0559	0.0216	0.0248	0.0456	0.0652	0.0216	0.287
Copper (Cu)-Total	mg/kg wwt	0.807	0.639	1.12	0.615	0.634	0.624	1.14	0.613	0.782	0.822	1.75	0.741	0.637	0.769	0.626	0.612	0.612	1.75
Iron (Fe)-Total	mg/kg wwt	80.6	46.4	145	35.4	63.6	69.5	367	46.1	233	45.2	492	86.3	36.4	36.1	42.5	55.8	35.4	492
Lead (Pb)-Total	mg/kg wwt	0.22	0.292	0.304	0.343	0.518	0.316	1.17	0.383	1.32	0.241	3.15	0.068	0.205	0.236	0.25	0.304	0.068	3.15
Lithium (Li)-Total	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	0.1
Magnesium (Mg)-Total	mg/kg wwt	362	217	580	125	280	220	261	135	167	185	240	387	166	213	204	264	125	580
Manganese (Mn)-Total	mg/kg wwt	74.8	71.3	277	28.7	62.3	90.3	48.4	53.6	34.4	57.6	42.8	36.5	65.7	89.7	68.7	44.4	28.7	277
Mercury (Hg)-Total	mg/kg wwt	0.0443	0.0714	0.0499	0.0651	0.0772	0.0673	0.139	0.0914	0.149	0.128	0.12	0.0114	0.073	0.0587	0.0489	0.0681	0.0114	0.149
Molybdenum (Mo)-Total	mg/kg wwt	0.0149	0.0157	0.0673	0.0139	0.0179	0.0247	0.0237	0.0149	0.0214	0.0162	0.0837	0.0195	0.0137	0.0167	0.0319	0.0225	0.0137	0.0837
Nickel (Ni)-Total	mg/kg wwt	0.725	0.314	1.26	0.141	0.335	0.282	0.696	0.234	1.07	0.555	1.28	2.44	0.259	0.459	1.13	0.685	0.141	2.44
Phosphorus (P)-Total	mg/kg wwt	289	209	376	173	287	226	249	173	169	313	329	96.2	182	235	293	238	96.2	376
Potassium (K)-Total	mg/kg wwt	860	860	1320	763	1010	857	739	603	596	872	904	359	648	770	785	676	359	1320
Rubidium (Rb)-Total	mg/kg wwt	0.962	1.93	2.11	1.94	1.64	1.4	1.86	1.61	2.12	2.62	3.58	0.29	0.466	0.503	0.737	0.685	0.29	3.58
Selenium (Se)-Total	mg/kg wwt	0.031	0.045	0.049	0.049	0.05	0.042	0.072	0.052	0.075	0.066	0.118	0.012	0.044	0.042	0.035	0.042	0.012	0.118
Sodium (Na)-Total	mg/kg wwt	11.2	16	160	14.3	19.9	24.4	16.7	10.4	25.3	14.9	26.8	15	13	17.7	39.1	18.9	10.4	160
Strontium (Sr)-Total	mg/kg wwt	2.15	3.12	8.98	1.96	12	4.57	3.83	1.24	1.54	1.34	6.12	8.83	2.43	3.28	5.95	8.59	1.24	12
Tellurium (Te)-Total	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	mg/kg wwt	0.00184	0.00384	0.00442	0.00203	0.00346	0.00271	0.0062	0.00322	0.00748	0.00288	0.00995	0.00081	0.00137	0.00063	0.00096	0.00086	0.00063	0.00995
Tin (Sn)-Total	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.021	<0.020	0.021	<0.020	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	0.021	0.04
Uranium (U)-Total	mg/kg wwt	0.00701	0.00761	0.0488	0.0056	0.012	0.0067	0.0758	0.00696	0.0184	0.00524	0.633	0.126	0.00496	0.00549	0.0179	0.0367	0.00496	0.633
Vanadium (V)-Total	mg/kg wwt	0.102	0.057	0.149	0.046	0.059	0.08	0.323	0.073	0.306	0.065	0.474	0.081	0.048	0.056	0.05	0.059	0.046	0.474
Zinc (Zn)-Total	mg/kg wwt	11.4	10.8	21.4	8.36	15.6	11.6	11.9	6.08	8.02	9.71	18.8	5.56	7.53	9.3	9.01	8.85	5.56	21.4
Zirconium (Zr)-Total	mg/kg wwt	0.069	0.051	0.167	<0.040	0.06	0.05	0.202	0.064	0.133	0.051	0.405	0.08	0.044	0.042	0.064	0.068	0.042	0.405

mg/kg wwt = milligram per kilogram wet weight; < = less than laboratory method detection limit

Table 3. Baseline Graminoid Analytical Results

Sample Location		AER-01	AER-02	AER-03	AER-04	AER-05	AER-06	AER-07	AER-08		AER-09	AER-10	AER-REP						
Sample Name		AER-GR-01	AER-GR-02	AER-GR-03	AER-GR-04	AER-GR-05	AER-GR-06	AER-GR-07	AER-GR-08	AER-GR-08-DUP	AER-GR-09	AER-GR-10	AER-GR-REP1	AER-GR-REP2	AER-GR-REP3	AER-GR-REP4	AER-GR-REP5		
Sampling Date		14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15		
Parameter	**Units**																	**MIN**	**MAX**
% Moisture	%	55.4	50.1	40.1	43.3	47.5	45.6	46.1	36.5	46.5	44.5	36.1	57.1	55.7	56.4	62	57.2	36.1	62
Aluminum (Al)-Total	mg/kg wwt	12.5	27.5	26.1	31.4	47.3	17.4	22.6	72.2	26.8	13.3	51.1	8.66	12.2	16.7	25.2	8.95	8.66	72.2
Antimony (Sb)-Total	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	0.0054	0.0039	0.046	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	0.046
Arsenic (As)-Total	mg/kg wwt	0.0129	0.0191	0.0312	0.0153	0.0278	0.0161	0.0196	0.0757	0.043	0.022	0.0981	0.0262	0.0187	0.025	0.0264	0.0194	0.0129	0.0981
Barium (Ba)-Total	mg/kg wwt	10.9	11.2	16.5	16.5	16.9	62.1	15.9	29.8	23.6	45	17.2	15.3	13.6	22.1	7.08	14.7	7.08	62.1
Beryllium (Be)-Total	mg/kg wwt	<0.0020	0.0154	0.0051	0.0067	0.0088	0.0146	0.0045	0.0067	0.0049	0.0038	0.0109	0.0032	0.0052	0.0081	0.0035	0.0026	0.0026	0.0154
Bismuth (Bi)-Total	mg/kg wwt	0.0058	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.002	0.0024	0.0044	<0.0020	0.0552	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.002	0.0552
Boron (B)-Total	mg/kg wwt	2.34	1.44	1.58	1.1	0.89	2.11	1.2	1.88	1.04	3.1	2	1.54	1.75	2.09	1.1	2.06	0.89	3.1
Cadmium (Cd)-Total	mg/kg wwt	0.011	0.0363	0.0135	0.0099	0.0119	0.0098	0.007	0.0168	0.0102	0.0111	0.0283	0.0093	0.012	0.0092	0.0156	0.0123	0.007	0.0363
Calcium (Ca)-Total	mg/kg wwt	925	1070	1380	848	860	1860	860	1430	760	1010	1360	948	1100	1380	754	1190	754	1860
Cesium (Cs)-Total	mg/kg wwt	0.0066	0.0149	0.0104	0.0151	0.0145	0.0086	0.0226	0.0128	0.0075	0.026	0.03	0.0076	0.0062	0.0071	0.0038	0.0045	0.0038	0.03
Chromium (Cr)-Total	mg/kg wwt	0.109	0.144	0.348	0.184	0.313	0.124	0.191	0.366	0.171	0.08	0.466	0.097	0.083	0.076	0.164	0.126	0.076	0.466
Cobalt (Co)-Total	mg/kg wwt	0.0498	0.215	0.127	0.0628	0.0721	0.0681	0.0534	0.131	0.0708	0.0877	0.0883	0.036	0.0435	0.0431	0.056	0.0291	0.0291	0.215
Copper (Cu)-Total	mg/kg wwt	1.61	1.69	1.33	0.862	0.809	2.11	0.906	1.2	0.848	1.8	1.98	1.33	1.41	1.37	1.17	1.23	0.809	2.11
Iron (Fe)-Total	mg/kg wwt	29.7	57.8	61.3	46.2	81.5	95.5	44.6	117	43.9	30.7	110	39.5	40.2	41.8	53.1	37.3	29.7	117
Lead (Pb)-Total	mg/kg wwt	0.0292	0.104	0.0883	0.0912	0.141	0.0614	0.0709	0.196	0.0835	0.0437	0.432	0.029	0.0387	0.0269	0.0452	0.0308	0.0269	0.432
Lithium (Li)-Total	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total	mg/kg wwt	704	553	479	239	263	453	308	415	265	601	357	598	475	605	346	535	239	704
Manganese (Mn)-Total	mg/kg wwt	155	325	500	96.8	99.9	388	54	214	87.9	136	69.7	221	328	227	257	387	54	500
Mercury (Hg)-Total	mg/kg wwt	0.0053	0.0083	0.0095	0.0108	0.0123	0.0068	0.0083	0.0164	0.0103	0.0106	0.018	0.0051	0.0047	0.0042	0.0058	0.0045	0.0042	0.018
Molybdenum (Mo)-Total	mg/kg wwt	0.157	0.197	0.181	0.163	0.072	2.99	0.146	0.321	0.211	0.433	0.414	0.209	0.162	0.264	0.205	0.15	0.072	2.99
Nickel (Ni)-Total	mg/kg wwt	2.53	1.86	1.74	1.07	0.631	1.67	1.23	1.44	1.07	3.4	1.23	1.47	1.38	1.8	1.24	1.05	0.631	3.4
Phosphorus (P)-Total	mg/kg wwt	481	365	359	382	341	700	344	449	266	595	379	541	388	302	351	346	266	700
Potassium (K)-Total	mg/kg wwt	3940	5080	3400	2490	1980	3860	2700	3210	2310	3480	3210	4800	3030	3040	2160	3130	1980	5080
Rubidium (Rb)-Total	mg/kg wwt	1.74	6.1	3	3.83	3.26	3	4.55	3.73	2.98	5.71	8.34	2.97	1.88	1.66	0.861	1.6	0.861	8.34
Selenium (Se)-Total	mg/kg wwt	<0.010	<0.010	0.012	0.014	0.016	0.011	0.01	0.021	0.014	<0.010	0.069	<0.010	<0.010	<0.010	0.011	<0.010	0.01	0.069
Sodium (Na)-Total	mg/kg wwt	7.2	9.5	9.8	13	10.7	12.6	10.4	17.1	12.3	20.2	14.6	17.8	23	16.5	30.1	20.4	7.2	30.1
Strontium (Sr)-Total	mg/kg wwt	3.57	4.99	6.38	3.91	5.13	17.6	3.81	6.76	4.79	9.77	4.19	6.47	6.61	9.5	4.62	6.79	3.57	17.6
Tellurium (Te)-Total	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0081	<0.0040	<0.0040	<0.0040	<0.0040	0.006	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.006	0.0081
Thallium (Tl)-Total	mg/kg wwt	0.00354	0.00109	0.00541	0.00131	0.00124	<0.00040	0.00706	0.00348	0.00423	0.00135	0.0531	0.00057	<0.00040	<0.00040	0.00056	<0.00040	0.00056	0.0531
Tin (Sn)-Total	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.025	<0.020	<0.020	<0.020	<0.020	<0.020	0.025	0.025
Uranium (U)-Total	mg/kg wwt	0.00112	0.0164	0.00698	0.00305	0.00687	0.002	0.00242	0.0128	0.00275	0.00134	0.00967	0.00893	0.0121	0.0174	0.0175	0.00267	0.00112	0.0175
Vanadium (V)-Total	mg/kg wwt	0.023	0.034	0.05	0.041	0.072	0.025	0.036	0.128	0.038	0.02	0.112	<0.020	<0.020	<0.020	0.039	<0.020	0.02	0.128
Zinc (Zn)-Total	mg/kg wwt	14.6	16.9	21.4	9.79	12.6	15.4	10.9	23.8	11	17	14.7	11.5	13.5	8.47	13.8	14.6	8.47	23.8
Zirconium (Zr)-Total	mg/kg wwt	<0.040	0.042	<0.040	0.111	0.053	<0.040	<0.040	0.079	<0.040	<0.040	0.053	<0.040	<0.040	<0.040	<0.040	<0.040	0.042	0.111

mg/kg wwt = milligram per kilogram wet weight; < = less than laboratory method detection limit

Table 4. Baseline Berry Analytical Results

	Sample Location	AER-01	AER-02	AER-03	AER-04	AER-05	AER-06	AER-07	AER-08		AER-09	AER-10	AER-REP						
	Sample Name	AER-BER-01	AER-BER-02	AER-BER-03	AER-BER-04	AER-BER-05	AER-BER-06	AER-BER-07	AER-BER-08	AER-BER-08-DUP	AER-BER-09	AER-BER-10	AER-BER-REP1	AER-BER-REP2	AER-BER-REP3	AER-BER-REP4	AER-BER-REP5		
	Sampling Date	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	15-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15	14-Aug-15		
Parameter	**Units**																	**MIN**	**MAX**
% Moisture	%	81.9	86.8	81.4	78.3	86.1	85	87.3	79.8	81.8	75.5	83.8	81.4	83.6	81	84.3	88.1	75.5	88.1
Aluminum (Al)-Total	mg/kg wwt	7.78	<0.40	<0.40	1.07	0.81	<0.40	0.84	<0.40	<0.40	1.47	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.81	7.78
Antimony (Sb)-Total	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Arsenic (As)-Total	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Barium (Ba)-Total	mg/kg wwt	0.15	0.263	0.266	0.451	0.258	0.304	0.236	0.309	0.295	0.637	0.228	0.25	0.259	0.289	0.251	0.223	0.15	0.637
Beryllium (Be)-Total	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Bismuth (Bi)-Total	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Boron (B)-Total	mg/kg wwt	0.27	<0.20	<0.20	0.3	<0.20	0.23	<0.20	0.28	0.27	0.44	<0.20	0.25	0.24	0.24	0.2	<0.20	0.2	0.44
Cadmium (Cd)-Total	mg/kg wwt	<0.0010	0.0011	<0.0010	<0.0010	0.0015	0.0021	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	0.0018	<0.0010	0.0017	0.0022	0.0011	0.0022
Calcium (Ca)-Total	mg/kg wwt	18	25.7	35.6	57.1	30.4	34.6	24.9	32.4	31.6	58.2	27.4	39	33.4	35.2	31	23.8	18	58.2
Cesium (Cs)-Total	mg/kg wwt	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	0.0011
Chromium (Cr)-Total	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt (Co)-Total	mg/kg wwt	0.0041	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0041	0.0041
Copper (Cu)-Total	mg/kg wwt	0.062	0.084	0.213	0.236	0.061	0.117	0.053	0.194	0.182	0.275	0.147	0.234	0.159	0.188	0.155	0.089	0.053	0.275
Iron (Fe)-Total	mg/kg wwt	8.14	<0.60	<0.60	0.79	0.99	<0.60	0.91	<0.60	<0.60	1.66	<0.60	0.85	<0.60	<0.60	0.69	<0.60	0.69	8.14
Lead (Pb)-Total	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Lithium (Li)-Total	mg/kg wwt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium (Mg)-Total	mg/kg wwt	21.7	11.4	21.8	28.2	14.3	17.4	9.56	20.6	19.4	34.1	14.9	24.3	18.1	21.8	18.2	11.7	9.56	34.1
Manganese (Mn)-Total	mg/kg wwt	0.333	1.01	5.49	8.95	0.743	7.48	0.962	3.08	2.93	8.19	4.17	6.1	6.16	4.84	5.97	4.64	0.333	8.95
Mercury (Hg)-Total	mg/kg wwt	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Molybdenum (Mo)-Total	mg/kg wwt	<0.0040	<0.0040	<0.0040	0.0055	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0055	0.0055
Nickel (Ni)-Total	mg/kg wwt	0.135	0.041	0.067	<0.040	<0.040	<0.040	<0.040	0.042	0.041	0.059	<0.040	0.066	0.069	0.066	0.07	0.055	0.041	0.135
Phosphorus (P)-Total	mg/kg wwt	35.1	25.5	42.3	43	23.6	31.5	20.2	41.6	38.5	61.9	27.2	56.6	36.6	43.2	37.9	25.8	20.2	61.9
Potassium (K)-Total	mg/kg wwt	255	138	289	317	162	190	140	311	290	428	230	301	239	303	227	129	129	428
Rubidium (Rb)-Total	mg/kg wwt	0.124	0.357	0.458	0.694	0.32	0.269	0.466	0.578	0.544	0.684	0.498	0.328	0.233	0.311	0.226	0.122	0.122	0.694
Selenium (Se)-Total	mg/kg wwt	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium (Na)-Total	mg/kg wwt	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Strontium (Sr)-Total	mg/kg wwt	0.05	0.112	0.063	0.09	0.082	0.078	0.075	0.077	0.076	0.133	0.037	0.127	0.099	0.087	0.099	0.069	0.037	0.133
Tellurium (Te)-Total	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Thallium (Tl)-Total	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Tin (Sn)-Total	mg/kg wwt	<0.020	0.033	0.032	0.033	0.04	0.038	<0.020	0.022	0.021	0.025	<0.020	0.026	0.024	0.023	<0.020	0.024	0.021	0.04
Uranium (U)-Total	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Vanadium (V)-Total	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc (Zn)-Total	mg/kg wwt	0.41	0.33	0.42	0.45	0.35	0.45	0.26	0.3	0.28	0.49	0.28	0.59	0.42	0.37	0.4	0.36	0.26	0.59
Zirconium (Zr)-Total	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

mg/kg wwt = milligram per kilogram wet weight; < = less than laboratory method detection limit

Table 5. Relative Percent Differences - Soils

Sample Name	AER-SOIL-08	AER-SOIL-08-DUP	
Sample Date	15-Aug-15	15-Aug-15	
Parameter			RPD (%)
Aluminum (Al)	7190	8370	15.2
Antimony (Sb)	<0.10	<0.10	-
Arsenic (As)	12.2	12.9	5.6
Barium (Ba)	73.9	86.8	16.1
Beryllium (Be)	0.36	0.4	10.5
Bismuth (Bi)	<0.20	<0.20	-
Boron (B)	<5.0	<5.0	-
Cadmium (Cd)	0.041	0.042	2.4
Calcium (Ca)	3150	3620	13.9
Chromium (Cr)	45.9	55.1	18.2
Cobalt (Co)	7.34	8.07	9.5
Copper (Cu)	6.55	7.91	18.8
Iron (Fe)	16300	18300	11.6
Lead (Pb)	6.11	6.86	11.6
Lithium (Li)	8.7	10.4	17.8
Magnesium (Mg)	4930	5850	17.1
Manganese (Mn)	264	280	5.9
Mercury (Hg)	0.0249	0.0089	**94.7**
Molybdenum (Mo)	0.32	0.33	3.1
Nickel (Ni)	23.5	27.3	15.0
Phosphorus (P)	735	859	15.6
Potassium (K)	1480	1890	24.3
Selenium (Se)	<0.20	<0.20	-
Silver (Ag)	<0.10	<0.10	-
Sodium (Na)	66	85	25.2
Strontium (Sr)	36.6	42.6	15.2
Thallium (Tl)	0.093	0.114	20.3
Tin (Sn)	<2.0	<2.0	-
Titanium (Ti)	683	798	15.5
Uranium (U)	1.36	1.56	13.7
Vanadium (V)	20.1	23	13.5
Zinc (Zn)	27.6	31.5	13.2
Zirconium (Zr)	2.6	4.6	**55.6**

Notes:
All concentrations in milligrams per kilogram (mg/kg)
< = less than laboratory method detection limit
- = not calculated because one or both concentrations were below the laboratory method detection limit
RPD = relative percent difference
50 RPD is greater than the 30% criterion for metals in soil.

Table 6. Relative Percent Differences - Vegetation

Sample Name	AER-LI-08	AER-LI-08-DUP		AER-GR-08	AER-GR-08-DUP		AER-BER-08	AER-BER-08-DUP	
Sample Date	15-Aug-15	15-Aug-15		15-Aug-15	15-Aug-15		15-Aug-15	15-Aug-15	
Parameter			RPD (%)			RPD (%)			RPD (%)
Aluminum (Al)-Total	31.6	147	**129**	72.2	26.8	**92**	<0.40	<0.40	-
Antimony (Sb)-Total	<0.0020	0.0064	-	0.0026	0.0054	**70**	<0.0020	<0.0020	-
Arsenic (As)-Total	0.0832	0.173	**70**	0.0757	0.043	**55**	<0.0040	<0.0040	-
Barium (Ba)-Total	3.42	9.26	**92**	29.8	23.6	23	0.309	0.295	5
Beryllium (Be)-Total	0.0023	0.0065	**95**	0.0067	0.0049	**31**	<0.0020	<0.0020	-
Bismuth (Bi)-Total	0.0055	0.012	**74**	0.0024	0.0044	**59**	<0.0020	<0.0020	
Boron (B)-Total	0.24	0.31	25	1.88	1.04	**58**	0.28	0.27	-
Cadmium (Cd)-Total	0.0477	0.0482	1	0.0168	0.0102	**49**	<0.0010	<0.0010	-
Calcium (Ca)-Total	460	407	12	1430	760	**61**	32.4	31.6	2
Cesium (Cs)-Total	0.0155	0.0337	**74**	0.0128	0.0075	**52**	<0.0010	<0.0010	-
Chromium (Cr)-Total	0.214	0.56	**89**	0.366	0.171	**73**	<0.010	<0.010	-
Cobalt (Co)-Total	0.035	0.113	**105**	0.131	0.0708	**60**	<0.0040	<0.0040	-
Copper (Cu)-Total	0.613	0.782	24	1.2	0.848	**34**	0.194	0.182	6
Iron (Fe)-Total	46.1	233	**134**	117	43.9	**91**	<0.60	<0.60	-
Lead (Pb)-Total	0.383	1.32	**110**	0.196	0.0835	**81**	<0.0040	<0.0040	-
Lithium (Li)-Total	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-
Magnesium (Mg)-Total	135	167	21	415	265	**44**	20.6	19.4	6
Manganese (Mn)-Total	53.6	34.4	**44**	214	87.9	**84**	3.08	2.93	5
Mercury (Hg)-Total	0.0914	0.149	**48**	0.0164	0.0103	**46**	<0.0010	<0.0010	-
Molybdenum (Mo)-Total	0.0149	0.0214	**36**	0.321	0.211	**41**	<0.0040	<0.0040	-
Nickel (Ni)-Total	0.234	1.07	**128**	1.44	1.07	29	0.042	0.041	2
Phosphorus (P)-Total	173	169	2	449	266	**51**	41.6	38.5	8
Potassium (K)-Total	603	596	1	3210	2310	**33**	311	290	7
Rubidium (Rb)-Total	1.61	2.12	27	3.73	2.98	22	0.578	0.544	6
Selenium (Se)-Total	0.052	0.075	**36**	0.021	0.014	**40**	<0.010	<0.010	-
Sodium (Na)-Total	10.4	25.3	**83**	17.1	12.3	**33**	<4.0	<4.0	-
Strontium (Sr)-Total	1.24	1.54	22	6.76	4.79	**34**	0.077	0.076	1
Tellurium (Te)-Total	<0.0040	<0.0040	-	<0.0040	<0.0040	-	<0.0040	<0.0040	-
Thallium (Tl)-Total	0.00322	0.00748	**80**	0.00348	0.00423	19	<0.00040	<0.00040	-
Tin (Sn)-Total	<0.020	0.021	-	<0.020	<0.020	-	0.022	0.021	5
Uranium (U)-Total	0.00696	0.0184	**90**	0.0128	0.00275	**129**	<0.00040	<0.00040	-
Vanadium (V)-Total	0.073	0.306	**123**	0.128	0.038	**108**	<0.020	<0.020	-
Zinc (Zn)-Total	6.08	8.02	28	23.8	11	**74**	0.3	0.28	7
Zirconium (Zr)-Total	0.064	0.133	**70**	0.079	<0.040	-	<0.040	<0.040	-

Notes:
All concentrations in milligram per kilogram wet weight (mg/kg wwt)
< = less than laboratory method detection limit
- = not calculated because one or both concentrations were below the laboratory method detection limit
RPD = relative percent difference
50 RPD is greater than the 30% criterion for metals in vegetation.

ATTACHMENT B

Screening Tables

ANNEX B-1

Air Quality

Table 1: Criteria Air Contaminants - 1-Hour Air Thresholds

Parameter	NDOE[a]	CCME NAAQO[b]			MOE[c]	ATSDR[d]	OEHHA[e]	WHO[f][g]	TCEQ[h]	Toxicological Endpoints and Derivations
		Desirable	Acceptable	Tolerable						
Criteria Air Contaminants										
Sulphur dioxide (SO_2)	**450**	450	900	—	690	26[i]	660	500[j]	200[i]	NDOE - human health, environment and aethetics, adopted from CCME; CCME - health and environment; MOE - health and vegetation; ATSDR - A minimal LOAEL of 0.1 ppm for bronchoconstriction in excercising asthmatics. An uncertainty factor of 9 was applied to give an MRL of 0.01 ppm. OEHHA - A consensus value from several studies. Impairment of airway function (especially in asthmatics) and based on NOAEL of 0.25 ppm; WHO - Changes in pulmonary function and respiratory symptoms; TCEQ - must meet NAAQS of 75 ppb.
Carbon monoxide (CO)	—	**15,000**	35,000	—	36,200	—	23,000	30,000[k]	40,100[i]	CCME - health and environment; MOE - health; OEHHA - Based on angina in persons with known cardiovascular diseases who are exercising heavily. A NOAEL of 1.1%-1.3% COHb in blood (corresponding to 20 ppm CO (23,000 µg/m^3), calculated toxicokinetically) was determined. Uncertainty factors of 1 were applied. WHO - Based on COHb levels. To protect non-smoking, middle-aged and elderly populations with documented or latent heart diseases, and fetuses of non-smoking pregnant women from untoward hypoxic effects, a COHb level of 2.5% should not be exceeded; TCEQ - must meet NAAQS of 35 ppm.
Nitrogen dioxide (NO_2)	**400**	—	400	1000	400	—	470	200	190[i]	NDOE - human health, environment and aethetics, adopted from CCME; CCME - health and environment; MOE - Health; OEHHA - Increased airway reactivity in asthmatics and based on a NOAEL of 0.25 ppm; WHO - Based on an increase in bronchial responsiveness in asthmatics; TCEQ - must meet NAAQS of 100 ppb.

Notes:
All values are in µg/m^3.
COHb = carboxyhemoglobin; LOAEL = Lowest Observed Adverse Effect Level; m^3 = cubic metre; µg/m^3 = microgram per cubic metre; MRL = minimal risk level; NAAQS = National Ambient Air Quality Standard; NAAQO = National Ambient Air Quality Objectives; NOAEL = no observed adverse effect level; PM = particulate matter; $PM_{2.5}$ = fine particulate matter; PM_{10} = coarse particulate matter; ppm = parts per million.
— = Value not available.
Shaded + Bold = Screening threshold selected for use in the assessment is the NDOE threshold. In the absence of an NDOE threshold, the most conservative threshold from all other jurisdictions is selected.
[a] Government of Nunavut Department of Environment (NDOE), Ambient Air Quality Standards. In: Environmental Guideline for Ambient Air Quality (October 2011).
[b] Canadian Council of Ministers of the Environment (CCME), Canadian National Ambient Air Quality Objectives: Process and Status. In: Canadian Environmental Quality Guidelines (1999
[c] Ontario Ministry of the Environment (MOE), Ontario's Ambient Air Quality Criteria. Standards Development Branch, MOE. (April 2012
[d] Agency of Toxic Substances and Disease Registry (ATSDR), Minimum Risk Levels (MRLs), October 2015 and supporting toxicological profiles. The ATSDR defines acute exposure as 14 days or les
[e] California Office of Environmental Health Hazard Assessment (OEHHA), Air Toxicology and Epidemiology. Acute, 8-hour and Chronic Reference Exposure Levels (June 2014)
[f] World Health Organization (WHO), WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005. Summary of risk assessment (2005
[g] World Health Organization (WHO), Air Quality Guidelines for Europe. Second Edition. WHO Regional Publications, European Series, No. 91 (2000
[h] Texas Commission on Environmental Quality (TCEQ), Interoffice memorandum, Effects Screening Levels (September 2015)

Table 2: Criteria Air Contaminants - 24-Hour Air Thresholds

Parameter	NDOE[a]	CCME NAAQO[b][c]			MOE[d]	ATSDR[e]	OEHHA[f]	WHO[g][h]	TCEQ[i]	Toxicological Endpoints and Derivations
		Desirable	Acceptable	Tolerable						
Criteria Air Contaminants										
Sulphur dioxide (SO_2)	**150**	150	300	800	275	—	—	20	—	NDOE - human health, environment and aethetics; CCME - health and environment; MOE - health and vegetation; WHO - lung function.
Carbon monoxide (CO)	—	**6000[i]**	15,000[i]	20,000[i]	15,700[i]	—	—	10,000[i]	—	CCME - health and environment; MOE - health; WHO - Based on COHb levels. To protect non-smoking, middle-aged and elderly populations with documented or latent heart diseases, and fetuses of non-smoking pregnant women from untoward hypoxic effects, a COHb level of 2.5% should not be exceeded.
Nitrogen dioxide (NO_2)	**200**	—	200	300	200	—	—	—	—	NDOE - human health, environment and aethetics; CCME - health and environment; MOE - health
$PM_{2.5}$	**30**	—	27	—	30	—	—	25	—	NDOE - human health, environment and aethetics; CCME - The CAAQS (that replaced the CWS in 2013) is a health-based standard that was derived to be protective of human health and the environment, but also account for feasibility and costs associated with reducing pollutant emissions; a value of 28 µg/m^3 is effective in 2015 and a value of 27 µg/m^3 is effective in 2020. These values are applicable to the 3-year average of the annual 98th percentile of the daily 24-h average concentrations. The 2020 standard was selected as it will be in effect during the life of the Project; MOE - The value is not technically an AAQC, but is the CWS for $PM_{2.5}$. The CWS is a long-term goal of minimizing risk that fine PM poses on human health and the environment. The MOE recommends that contribution of $PM_{2.5}$ from a single facility be less than 25 µg/m^3 (24-hour) to achieve the CWS target; WHO - The AQG is based on a $PM_{2.5}$:PM_{10} ratio of 0.5. Therefore, the AQG reflects the relationship between the distributions of 24-h means (and its 99th percentile) and annual average concentrations.
PM_{10}	—	—	**NV**	—	50	—	—	50	—	CCME - The NAAQOs for PM have been replaced by CAAQS and the CCME does not provide a CAAQS for PM_{10}. A CAAQS is only available for $PM_{2.5}$ as the greatest human health effects related to PM are are associated with the fine fraction. Actions to reduce $PM_{2.5}$ emissions will also reduce concentrations of the coarse fraction (PM_{10}); MOE - interim AAQC, provided for decision making; WHO - The AQG is based on a 0.46 to 0.62% increase in mortality per 10 µg/m^3 increase in PM_{10}. The AQG reflects the relationship between the distributions of 24-h means (and its 99th percentile) and annual average concentrations.
Total Suspended Particulates (TSP)	**120**	—	120	400	120	—	—	—	—	NDOE - human health, environment and aethetics; CCME - health and environment; MOE - visibility

Notes:
All values are in µg/m^3, unless otherwise noted.
AAQC = Ambient Air Quality Criteria; AQG = Air Quality Guideline; CAAQS = Canadian ambient air quality standard; COHb = carboxyhemoglobin; CWS = Canada-wide Standard; h = hour; m^3 = cubic metre; µg/m^3 = microgram per cubic metre; mg/m^3 = milligram per cubic metre; MRL = minimal risk level; NAAQO = National Ambient Air Quality Objectives; NV = no value; PM = particulate matter; $PM_{2.5}$ = fine particulate matter; PM_{10} = coarse particulate matter; REL = reference exposure level.
— = Value not available.
Shaded + Bold = Screening threshold selected for use in the assessment is the NDOE threshold. In the absence of an NDOE threshold, the most conservative threshold from all other jurisdictions is selected.
[a] Government of Nunavut Department of Environment (NDOE), Ambient Air Quality Standards. In: Environmental Guideline for Ambient Air Quality (October 2011).
[b] Canadian Council of Ministers of the Environment (CCME), Canadian National Ambient Air Quality Objectives: Process and Status. In: Canadian Environmental Quality Guidelines (1999).
[c] Guidelines from the Canadian Council of Ministers of the Environment (CCME), Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone (2012).
[d] Ontario Ministry of the Environment (MOE), Ontario's Ambient Air Quality Criteria. Standards Development Branch, MOE. (April, 2012).
[e] Agency of Toxic Substances and Disease Registry (ATSDR), Minimum Risk Levels (MRLs), October 2015 and supporting toxicological profiles.
[f] California Office of Environmental Health Hazard Assessment (OEHHA), Air Toxicology and Epidemiology. Acute, 8-hour and Chronic Reference Exposure Levels (January 2014).
[g] World Health Organization (WHO), WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005. Summary of risk assessment (2005).
[h] World Health Organization (WHO), Air Quality Guidelines for Europe. Second Edition. WHO Regional Publications, European Series, No. 91 (2000).
[i] Texas Commission on Environmental Quality (TCEQ), Interoffice memorandum, Effects Screening Levels (September 2015).
[i] 8-hour.

Table 3: Criteria Air Contaminants - Annual Air Thresholds

Parameter	NDOE[a]	CCME NAAQO[b][c]			MOE[d]	ATSDR[e]	OEHHA[f][g]	WHO[h][i]	TCEQ[j]	Toxicological Endpoints and Derivations
		Desirable	Acceptable	Tolerable						
Criteria Air Contaminants										
Sulphur dioxide (SO_2)	**30**	30	60	—	55	—	—	50	—	NDOE - human health, environment and aethetics (annual arithmetic mean); MOE - health and vegetation; CCME - health and environment; WHO - Based on a LOAEL of 100 µg/m^3 for respiratory symptoms and illnesses or differences in lung function values.
Carbon monoxide (CO)	—	—	—	—	—	—	—	—	—	—
Nitrogen dioxide (NO_2)	**60**	60	100	—	—	—	—	40	99.7[k]	NDOE - human health, environment and aethetics (annual arithmetic mean); CCME - health and environment; MOE - health; WHO - Based on outdoor epidemiological studies that found exposures to NO_2 in ambient air associated with increased respiratory symptoms and lung function decreases in children; TCEQ - must meet NAAQS of 53 ppb.
$PM_{2.5}$	—	—	**8.8**	—	—	—	—	10	12	CCME – The CAAQS (that replaced the CWS in 2013) is a health-based standard that was derived to be protective of human health and the environment, but also account for feasibility and costs associated with reducing pollutant emissions; a value of 10 µg/m^3 is effective in 2015 and a value of 8.8 µg/m^3 is effective in 2020. This value is applicable to the 3-year average of the annual average concentrations. The 2020 standard was selected as it will be in effect during the life of the Project; WHO - The AQG is based on cardiopulmonary and lung cancer mortality; TCEQ - must meet NAAQS of 12 µg/m^3.
PM_{10}	—	—	**NV**	—	—	—	—	20	—	WHO - The WHO AQG is based on a $PM_{2.5}$:PM_{10} ratio of 0.5. The lowest level at which total cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to $PM_{2.5}$.
Total Suspended Particulates (TSP)	**60**	60	70	—	60	—	—	—	—	NDOE - human health, environment and aethetics (annual geometric mean); CCME - health and environment; MOE - visibility.

Notes:

All values are in µg/m^3, unless otherwise noted.

AQG = Air Quality Guideline; CAAQS = Canadian ambient air quality standard; LOAEL = Lowest Observed Adverse Effect Level; µg/L = microgram per litre; µg/m^3 = microgram per cubic metre; Mg = magnesium; mg/kg/day = milligram per kilogram per day; mg/m^3 = milligram per cubic metre; NAAQS = National Ambient Air Quality Standard; PAH = polycyclic aromatic hydrocarbon; NAAQO = National Ambient Air Quality Objectives; NOAEL = no observable adverse effect level; PM = particulate matter; $PM_{2.5}$ = fine particulate matter; PM_{10} = coarse particulate matter; ppm = parts per million; REL = reference exposure level.

— = Value not available.

Shaded + Bold = Screening threshold selected for use in the assessment is the NDOE threshold. In the absence of an NDOE threshold, the most conservative threshold from all other jurisdictions is selected.

[a] Government of Nunavut Department of Environment (NDOE), Ambient Air Quality Standards. In: Environmental Guideline for Ambient Air Quality (October 2011)

[b] Canadian Council of Ministers of the Environment (CCME), Canadian National Ambient Air Quality Objectives: Process and Status. In: Canadian Environmental Quality Guidelines (1999).

[c] Guidelines from the Canadian Council of Ministers of the Environment (CCME), Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone (2012)

[d] Ontario Ministry of the Environment (MOE), Ontario's Ambient Air Quality Criteria. Standards Development Branch, MOE (April, 2012).

[e] Agency of Toxic Substances and Disease Registry (ATSDR), Minimum Risk Levels (MRLs), October 2015 and supporting toxicological profiles.

[f] California Office of Environmental Health Hazard Assessment (OEHHA), Air Toxicology and Epidemiology. Acute, 8-hour and Chronic Reference Exposure Levels (June 2014).

[g] California Office of Environmental Health Hazard Assessment (OEHHA), 2012, Toxicity Criteria Database.

[h] World Health Organization (WHO), WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005. Summary of risk assessment (2005).

[i] World Health Organization (WHO), Air Quality Guidelines for Europe. Second Edition. WHO Regional Publications, European Series, No. 91 (2000).

[j] Texas Commission on Environmental Quality (TCEQ), Interoffice memorandum, Effects Screening Levels (September 2015). Guideline was provided from TCEQ if values were not available from any of the other jurisdications.

[k] TCEQ refers to US EPA NAAQS value in units of parts per million (ppm) or parts per billion (ppb) which is converted to µg/m^3 using molecular weight. United States Environmental Protection Agency (US EPA), National Ambient Air Quality Standards (NAAQS). Online: https://www3.epa.gov/ttn/naaqs/criteria.html.Last updated March 201

Attachment B-1: Air Quality Screening Tables

Table 4: Screening of 1-hour Maximum Predicted CAC Air Concentrations (Approved Project)

Parameter	Selected 1-hour Screening Threshold (µg/m^3)	Baseline + 10% (µg/m^3)[a]	Maximum Predicted 1-hour Concentration (µg/m^3)[b]															Retain for CAC Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Criteria Air Contaminants (CAC)																		
Sulphur dioxide (SO_2)	450	3.0	5.94	6.24	9.80	9.64	6.38	6.33	6.26	21.95	5.97	6.44	13.07	10.07	5.98	6.21	9.24	7.64	No
Carbon monoxide (CO)	15,000	427	804.48	820.02	992.31	978.48	828.13	825.68	820.78	1537.89	806.08	828.36	1142.54	1011.69	808.08	817.75	962.01	887.35	No
Nitrogen dioxide (NO_2)	400	13.9	62.56	72.57	107.14	97.79	78.35	73.87	73.36	177.44	66.73	76.36	122.34	100.05	66.70	68.76	98.32	88.42	No

Notes:

µg/m^3 = microgram per cubic metre; $PM_{2.5}$ = particulate matter fine fraction; PM_{10} = particulate matter coarse fraction.

Shaded + Bold = Exceeds 1-hour Screening Threshold and Baseline+10%

[a] Baseline concentrations are based on the average 90th percentile from multiple sites. A 10% factor was applied to account for natural variability

[b] Air concentrations are the sum of baseline concentrations and maximum predicted 1-hour concentrations provided in the Air Quality TSD.

Table 5: Screening of 24-hour Maximum Predicted CAC Air Concentrations (Approved Project)

Parameter	Selected 24-hour Screening Threshold (µg/m^3)	Baseline + 10% (µg/m^3)[b]	Maximum Predicted 24-hour Concentration (µg/m^3)[c]															Retain for CAC Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Criteria Air Contaminants (CAC)																		
Sulphur dioxide (SO_2)	150	3.0	5.44	5.60	6.37	6.11	5.66	5.63	5.57	9.19	5.48	5.48	6.52	6.14	5.45	5.48	6.18	5.62	No
Carbon monoxide (CO)[a]	6,000	423	774.85	778.92	838.37	822.58	788.75	787.20	786.01	994.37	775.59	783.90	867.49	817.92	777.72	776.46	812.08	790.13	No
Nitrogen dioxide (NO_2)	200	12.54	26.36	28.73	35.38	38.70	29.37	29.01	28.69	84.56	29.52	27.24	38.46	31.59	26.33	28.52	36.98	29.04	No
$PM_{2.5}$	30	7.37	13.54	13.60	15.08	15.35	13.89	13.85	13.76	25.58	13.61	13.72	15.84	15.06	13.67	13.66	15.07	14.17	No
PM_{10}	NV[d]	—	7.95	8.93	28.76	13.20	10.88	10.70	10.19	72.31	7.76	8.39	24.09	19.65	8.62	9.44	16.48	11.68	No
Total Suspended Particulates (TSP)	120	—	10.08	10.33	74.74	27.54	18.87	18.35	16.84	157.81	9.85	11.52	60.87	48.50	12.25	15.19	33.29	22.20	No[e]

Notes:

µg/m^3 = microgram per cubic metre; $PM_{2.5}$ = particulate matter fine fraction; PM_{10} = particulate matter coarse fraction.

— = Value not available.

NV

Shaded = Exceeds 24-hour Screening Threshold

Shaded + Bold = Exceeds 24-hour Screening Threshold and Baseline+10%

[a] 8-hour

[b] Baseline concentrations are based on the average 90th percentile from multiple sites. A 10% factor was applied to account for natural variability in air concentrations.

[c] Air concentrations are the sum of baseline concentrations (as available) and maximum predicted 1-hour concentrations provided in the Air Quality TSD.

[d] The health effects due to PM_{10} will be evaluated based on the the $PM_{2.5}$ concentrations. The greatested human health effects due to PM are associated with the fine fraction.

[e] The standard for TSP is based on nuisance rather than human health.

Table 6: Screening of Annual Maximum Predicted CAC Air Concentrations (Approved Project)

Parameter	Selected Annual-hour Screening Threshold (µg/m^3)	Baseline + 10% (µg/m^3)[b]	Maximum Predicted Annual Concentration (µg/m^3)[c]															Retain for CAC Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Criteria Air Contaminants (CAC)																		
Sulphur dioxide (SO_2)	30	0.33	0.57	0.57	0.59	0.60	0.57	0.57	0.57	0.79	0.57	0.57	0.60	0.58	0.57	0.57	0.58	0.58	No
Carbon monoxide (CO)[a]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	No
Nitrogen dioxide (NO_2)	60	5.50	10.12	10.13	10.63	11.13	10.24	10.22	10.20	19.12	10.19	10.18	11.00	10.43	10.15	10.23	10.50	10.41	No
$PM_{2.5}$	8.8	3.96	7.22	7.22	7.42	7.39	7.24	7.24	7.23	**8.87**	7.22	7.23	7.40	7.31	7.22	7.23	7.31	7.27	**Yes**
PM_{10}	NV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	No
Total Suspended Particulates (TSP)	60	—	3.74	3.70	4.98	5.18	3.89	3.88	3.85	18.78	3.77	3.84	5.40	4.83	3.77	3.87	5.11	4.31	No

Notes:

µg/m^3 = microgram per cubic metre; $PM_{2.5}$ = particulate matter fine fraction; PM_{10} = particulate matter coarse fraction.

— = Value not available.

Shaded = Exceeds Annual-hour Screening Threshold

Shaded + Bold = Exceeds Annual-hour Screening Threshold and Baseline + 10%

[a] 8-hour

[b] Baseline concentrations are based on the average 50th percentile from multiple sites. A 10% factor was applied to account for natural variability in air concentrations.

[c] Air concentrations are the sum of baseline concentrations (as available) and maximum predicted 1-hour concentrations provided in the Air Quality TSD.

Attachment B-1: Air Quality Screening Tables

Table 7: Screening of 1-hour Maximum Predicted CAC Air Concentrations (Expansion Project)

Parameter	Selected 1-hour Screening Threshold (µg/m^3)	Baseline + 10% (µg/m^3)[a]	Maximum Predicted 1-hour Concentration (µg/m^3)[b]															Retain for CAC Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Criteria Air Contaminants (CAC)																		
Sulphur dioxide (SO_2)	450	3.0	16.96	25.99	84.14	85.99	42.65	39.95	33.13	372.87	20.79	28.23	161.56	86.63	23.43	23.56	85.98	41.85	No
Carbon monoxide (CO)	15,000	427	1191.06	1519.20	3666.89	3653.49	2106.41	2021.61	1800.82	13581.47	1349.09	1601.61	6259.79	3699.28	1410.14	1409.52	3622.53	2066.76	No
Nitrogen dioxide (NO_2)	400	13.9	88.69	104.81	185.92	180.61	109.18	105.19	102.29	**451.92**	89.85	105.14	263.57	194.09	96.24	93.29	167.42	127.52	**Yes**

Notes:

µg/m^3 = microgram per cubic metre; $PM_{2.5}$ = particulate matter fine fraction; PM_{10} = particulate matter coarse fraction.

Shaded + Bold = Exceeds 1-hour Screening Threshold and Baseline+10%

[a] Baseline concentrations are based on the average 90th percentile from multiple sites. A 10% factor was applied to account for natural variability

[b] Air concentrations are the sum of baseline concentrations and maximum predicted 1-hour concentrations provided in the Air Quality TSD.

Table 8: Screening of 24-hour Maximum Predicted CAC Air Concentrations (Expansion Project)

Parameter	Selected 24-hour Screening Threshold (µg/m^3)	Baseline + 10% (µg/m^3)[b]	Maximum Predicted 24-hour Concentration (µg/m^3)[c]															Retain for CAC Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Criteria Air Contaminants (CAC)																		
Sulphur dioxide (SO_2)	150	3.0	6.82	8.51	22.97	25.00	16.75	15.59	14.23	80.91	7.98	7.50	32.99	23.02	7.17	7.96	18.86	8.76	No
Carbon monoxide (CO)[a]	6,000	423	880.42	929.89	1526.16	1419.24	1043.71	1017.25	1016.12	4172.83	885.57	958.25	2344.76	1464.92	887.45	926.30	1299.62	1010.00	No
Nitrogen dioxide (NO_2)	200	12.54	31.84	32.84	55.78	57.25	44.47	42.91	40.96	161.04	41.43	31.88	60.24	48.31	30.54	35.94	54.58	36.34	No
$PM_{2.5}$	30	7.37	13.69	13.76	15.71	16.22	14.49	14.40	14.26	29.93	13.81	13.97	18.46	16.03	13.80	13.88	15.47	14.43	No
PM_{10}	NV[d]	—	9.12	9.76	46.09	22.13	19.29	19.05	17.20	146.33	9.09	11.21	45.55	29.75	10.20	12.24	24.46	17.59	No
Total Suspended Particulates (TSP)	120	—	9.70	9.74	69.18	24.05	19.21	18.97	17.14	174.24	9.43	11.46	58.71	36.48	11.01	12.93	28.33	20.06	No[e]

Notes:

µg/m^3 = microgram per cubic metre; $PM_{2.5}$ = particulate matter fine fraction; PM_{10} = particulate matter coarse fraction.

— = Value not available.

NV

Shaded = Exceeds 24-hour Screening Threshold

Shaded + Bold = Exceeds 24-hour Screening Threshold and Baseline+10%

[a] 8-hour

[b] Baseline concentrations are based on the average 90th percentile from multiple sites. A 10% factor was applied to account for natural variability in air concentrations.

[c] Air concentrations are the sum of baseline concentrations (as available) and maximum predicted 1-hour concentrations provided in the Air Quality TSD.

[d] The health effects due to PM_{10} will be evaluated based on the the $PM_{2.5}$ concentrations. The greatested human health effects due to PM are associated with the fine fraction.

[e] The standard for TSP is based on nuisance rather than human health and therefore was not retained in the HHERA.

Attachment B-1: Air Quality Screening Tables

Table 9: Screening of Annual Maximum Predicted CAC Air Concentrations (Expansion Project)

Parameter	Selected Annual-hour Screening Threshold (µg/m^3)	Baseline + 10% (µg/m^3)[a]	Maximum Predicted Annual Concentration (µg/m^3)[b]															Retain for CAC Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Criteria Air Contaminants (CAC)																		
Sulphur dioxide (SO_2)	30	0.33	0.62	0.63	0.89	1.11	0.70	0.69	0.68	5.56	0.64	0.66	1.09	0.92	0.63	0.67	0.86	0.75	No
Carbon monoxide (CO)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	No
Nitrogen dioxide (NO_2)	60	5.50	10.47	10.41	11.53	13.40	10.76	10.71	10.66	35.10	10.66	10.62	12.17	11.34	10.54	10.86	11.55	11.42	No
$PM_{2.5}$	8.8	3.96	7.24	7.24	7.46	7.55	7.28	7.27	7.27	**10.27**	7.24	7.26	7.57	7.42	7.24	7.26	7.44	7.34	**Yes**
PM_{10}	NV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	No
Total Suspended Particulates (TSP)	60	—	3.74	3.70	4.98	5.18	3.89	3.88	3.85	18.78	3.77	3.84	5.40	4.83	3.77	3.87	5.11	4.31	No

Notes:

µg/m^3 = microgram per cubic metre; $PM_{2.5}$ = particulate matter fine fraction; PM_{10} = particulate matter coarse fraction.

— = Value not available.

Shaded = Exceeds Annual-hour Screening Threshold

Shaded + Bold = Exceeds Annual-hour Screening Threshold and Baseline + 10%

[a] Baseline concentrations are based on the average 50th percentile from multiple sites. A 10% factor was applied to account for natural variability in air concentrations.

[b] Air concentrations are the sum of baseline concentrations (as available) and maximum predicted 1-hour concentrations provided in the Air Quality TSD.

Attachment B-1: Air Quality Screening Tables

Table 10: 24-Hour Metals Screening Thresholds

Parameter	NDOE[a]	CCME NAAQO[b][c]			MOE[d]	ATSDR[e]	OEHHA[f]	WHO[g]	TCEQ[h]	Toxicological Endpoints and Derivations
		Desirable	Acceptable	Tolerable						
Aluminum	—	—	—	—	—	—	—	—	—	—
Antimony	—	—	—	—	**25**	—	—	—	—	MOE - health
Arsenic	—	—	—	—	0.3	—	**0.015**[i]	—	—	MOE - health; OEHHA - The 8-hr REL was taken to be equivalent to the chronic REL due to the possibility of repeated exposure and the relatively slow clearance of arsenic compounds. The chronic REL was based on a LOAEL of 0.23 µg/m^3 for decrease in intellectual function and adverse effects on neurobehavioural development in children. An uncertainty factor of 30 was applied.
Barium	—	—	—	—	**10**	—	—	—	—	MOE - health; total water soluble
Beryllium	—	—	—	—	**0.01**	—	—	—	—	MOE - health
Bismuth	—	—	—	—	—	—	—	—	—	—
Cadmium	—	—	—	—	**0.025**	—	—	—	—	MOE - health
Calcium	—	—	—	—	—	—	—	—	—	—
Chromium	—	—	—	—	0.5	**0.1**	—	—	—	MOE - health for metallic, divalent and trivalent chromium compounds; ATSDR - The MRL for soluble Cr(III) particulate compounds was based on a LOAEL of 3 mg/m^3 for nasal and larynx lesions. The LOAEL was adjusted for intermittent exposure (6 h/day, 5 days/week) and a human equivalent concentration of 0.078. An uncertainty factor of 300 was applied.
Cobalt	—	—	—	—	**0.1**	—	—	—	—	MOE - health
Copper	—	—	—	—	**50**	—	—	—	—	MOE - health
Gold	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	**4**	—	—	—	—	MOE - health
Lead	—	—	—	—	**0.5**	—	—	—	—	MOE - health
Lithium	—	—	—	—	**20**	—	—	—	—	MOE - health
Magnesium	—	—	—	—	—	—	—	—	—	—
Manganese	—	—	—	—	**0.1**	—	0.17[i]	—	—	MOE - health effects for chemical present as particulate matter, $PM_{2.5}$ fraction. The value for the $PM_{2.5}$ fraction was selected as it was the most conservative; OEHHA - The 8-h REL is based on a benchmark concentration of 72 µg/m^3 for impaired neurobehaviour (visual reaction time, eye-hand coordination and hand steadiness). The benchmark concentration was adjusted for duration (5 days/week) and an uncertainty factor of 300 was applied.
Molybdenum	—	—	—	—	**120**	—	—	—	—	MOE - particulate
Nickel	—	—	—	—	0.1	0.2	**0.06**[i]	—	—	MOE - health effects for chemical present as particulate matter, PM_{10} fraction. The value for the PM_{10} fraction was selected as it was the most conservative; ATSDR - The MRL was based on a NOAEL of 0.06 mg/m^3 for chronic active inflammation in rats. The NOAEL was adjusted for exposure duration (6 h/day, 5 days/week) and a human equivalent concentration of 0.474. An uncertainty factor of 30 was applied; OEHHA - The 8-h REL was based on a NOAEL of 0.03 µg/m^3 for alveolar macrophage hyperplasia, alveolar proteinosis and chronic active inflammation. The NOAEL was corrected for a duration time of 5 days/week, a dosimetric adjustment factor of 0.264 and an uncertainty factor of 100.
Potassium	—	—	—	—	—	—	—	—	—	—
Selenium	—	—	—	—	**10**	—	—	—	—	MOE - health
Silver	—	—	—	—	**1**	—	—	—	—	MOE - health
Sodium	—	—	—	—	—	—	—	—	—	—
Strontium	—	—	—	—	**120**	—	—	—	—	MOE - particulate
Thallium	—	—	—	—	—	—	—	—	—	—
Tin	—	—	—	—	**10**	—	—	—	—	MOE - health
Titanium	—	—	—	—	**120**	—	—	—	—	MOE - particulate
Uranium	—	—	—	—	0.15	**0.1**	—	—	—	MOE - health effects for chemical present as particulate matter, PM_{10} fraction. The value for the PM2.5 fraction was selected as it was the most conservative; ATSDR - The MRL for soluble uranium (soluble salts) was based on a LOAEL of 0.15 mg/m^3 for minimal microscopic lesions in the renal tubules in dogs. The LOAEL was adjusted for duration (6 h/day, 6 days/week) and an uncertainty factor of 300 was applied.
Vanadium	—	—	—	—	2	—	—	**1**	—	MOE - health; WHO - Based on a LOAEL of 20 µg/m^3 for chronic upper respiratory tract symptoms. A protection factor of 20 was applied based on minimal upper respiratory tract effects and susceptible sub-populations.
Yttrium	—	—	—	—	—	—	—	—	—	—
Zinc	—	—	—	—	**120**	—	—	—	—	MOE - particulate

Notes:
All values are in µg/m^3, unless otherwise noted.
Cr(III) = trivalent chromium; h = hour; LOAEL = Lowest Observed Adverse Effect Level; m^3 = cubic metre; µg/m^3 = microgram per cubic metre; mg/m^3 = milligram per cubic metre; MRL = minimal risk level; NAAQC = Ambient Air Quality Criteria; PM = particulate matter; NOAEL = no observable adverse effect level; REL = reference exposure level.
— = Value not available.
Shaded + Bold = Screening threshold selected for use in the assessment is the NDOE value. In the absence of NDOE, the most conservative value of all other jurisdictions is selected.
[a] Government of Nunavut Department of Environment (NDOE), Ambient Air Quality Standards. In: Environmental Guideline for Ambient Air Quality (October 2011).
[b] Canadian Council of Ministers of the Environment (CCME), Canadian national ambient air quality objectives: Process and status. In: Canadian environmental quality guidelines (1999).
[c] Guidelines from the Canadian Council of Ministers of the Environment (CCME), Canada-Wide Standards for Particulate Matter and Ozone. 2000.
[d] Ontario Ministry of the Environment (MOE), Ontario's Ambient Air Quality Criteria. Standards Development Branch, MOE. (April, 2012).
[e] Agency of Toxic Substances and Disease Registry (ATSDR), Minimum Risk Levels (MRLs), October 2015 and supporting toxicological profiles.
[f] California Office of Environmental Health Hazard Assessment (OEHHA), Air Toxicology and Epidemiology. Acute, 8-hour and Chronic Reference Exposure Levels (January 2014).
[g] World Health Organization (WHO), Air Quality Guidelines for Europe. Second Edition. WHO Regional Publications, European Series, No. 91 (2000).
[h] Texas Commission on Environmental Quality (TCEQ), Interoffice memorandum, Effects Screening Levels (September 2015). Guideline was provided from TCEQ if values were not available from any of the other jurisdications.

Table 11: Screening of 24-hour Maximum Predicted Metal Concentrations (Approved Project)

Parameter	Selected 24-hour Screening Threshold (µg/m³)	Maximum Predicted 24-hour Concentration (µg/m³)															Retain for 24-hour Inhalation Assessment?
		Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Aluminum	—	0.69782	0.7153	5.17375	1.90625	1.30624	1.27016	1.1655	10.9251	0.6817	0.7974	4.2138	3.3578	0.8478	1.0519	2.3045	1.5366	No
Antimony	25	0.000039	0.000040	0.000293	0.000108	0.000074	0.000072	0.00007	0.00062	0.00004	0.00005	0.00024	0.00019	0.00005	0.00006	0.00013	0.00009	No
Arsenic	0.015[(a)]	0.00112	0.00115	0.00830	0.00306	0.00210	0.002037	0.00187	0.01752	0.00109	0.00128	0.00676	0.00539	0.00136	0.00169	0.00370	0.00246	**Yes**
Barium	10	0.0039	0.004	0.029224	0.010768	0.007378	0.007175	0.006583	0.061711	0.003851	0.004504	0.023802	0.018967	0.004789	0.005942	0.013017	0.008679	No
Beryllium	0.01	0.0000073	0.0000075	0.0000544	0.0000200	0.0000137	0.0000134	0.000012	0.000115	0.000007	0.000008	0.000044	0.000035	0.000009	0.000011	0.000024	0.000016	No
Bismuth	—	0.0000020	0.0000021	0.0000149	0.0000055	0.0000038	0.0000037	0.0000034	0.000032	0.000002	0.000002	0.000012	0.000010	0.000002	0.000003	0.000007	0.000004	No
Cadmium	0.025	0.00000	0.00000	0.00002	0.00001	0.00001	0.00000	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	No
Calcium	—	0.398413	0.408368	2.953893	1.088352	0.745783	0.725183	0.66543	6.23755	0.38922	0.45524	2.40582	1.91712	0.484021	0.600567	1.31572	0.87729	No
Chromium	0.1	0.00168	0.001718	0.012429	0.004579	0.003138	0.003051	0.002800	0.026245	0.00164	0.00192	0.01012	0.00807	0.00204	0.00253	0.0055	0.00369	No
Cobalt	0.1	0.000270	0.000277	0.002002	0.000738	0.000506	0.000492	0.000451	0.00423	0.000264	0.000309	0.00163	0.001300	0.000328	0.000407	0.00089	0.000595	No
Copper	50	0.0007	0.0007	0.0053	0.0020	0.0013	0.0013	0.0012	0.0112	0.0007	0.0008	0.0043	0.0034	0.0009	0.0011	0.0024	0.0016	No
Gold	—	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	No
Iron	4	0.766	0.785	5.681	2.093	1.434	1.395	1.280	11.995	0.748	0.875	4.627	3.687	0.931	1.155	2.530	1.687	**Yes**
Lead	0.5	0.00012	0.000123	0.000893	0.000329	0.000225	0.000219	0.000201	0.001885	0.000118	0.000138	0.000727	0.000579	0.000146	0.000181	0.000398	0.000265	No
Lithium	20	0.0003259	0.000334	0.002416	0.000890	0.000610	0.000593	0.000544	0.005102	0.000318	0.000372	0.001968	0.001568	0.000396	0.000491	0.001076	0.000718	No
Magnesium	—	0.2113383	0.216619	1.566894	0.577317	0.395601	0.384674	0.352980	3.308709	0.206463	0.241482	1.276167	1.016936	0.256749	0.318571	0.697924	0.465358	No
Manganese	0.1	0.007944	0.008142	0.058897	0.021701	0.014870	0.014459	0.013268	0.124370	0.007761	0.009077	0.047969	0.038225	0.009651	0.011975	0.026234	0.017492	**Yes**
Molybdenum	120	0.0000121	0.0000124	0.0000897	0.0000330	0.0000226	0.0000220	0.0000202	0.0001893	0.0000118	0.0000138	0.0000730	0.0000582	0.0000147	0.0000182	0.0000399	0.0000266	No
Nickel	0.06[(a)]	0.001	0.001	0.005	0.002	0.001	0.001	0.001	0.01	0.001	0.001	0.004	0.003	0.001	0.001	0.002	0.002	No
Potassium	—	0.13372	0.13706	0.99139	0.365273	0.25030	0.243386	0.22333	2.09345	0.13063	0.15279	0.80744	0.64342	0.16245	0.20156	0.44158	0.29444	No
Selenium	10	0.00001	0.00001	0.00009	0.00003	0.00002	0.000022	0.00002	0.00019	0.00001	0.00001	0.00007	0.00006	0.00001	0.00002	0.00004	0.00003	No
Silver	1	0.00000	0.00000	0.00002	0.00001	0.00001	0.00001	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00000	0.00000	0.0000	0.00001	No
Sodium	—	0.159714	0.163705	1.184147	0.436295	0.298967	0.290709	0.266757	2.50049	0.156030	0.182495	0.96444	0.76853	0.194033	0.240753	0.52744	0.35168	No
Strontium	120	0.002	0.002	0.016	0.006	0.004	0.004	0.004	0.03	0.002	0.002	0.01	0.010	0.003	0.003	0.007	0.005	No
Thallium	—	0.000003	0.000003	0.000023	0.000008	0.000006	0.000006	0.000005	0.000048	0.000003	0.000004	0.000019	0.000015	0.000004	0.000005	0.000010	0.000007	No
Tin	10	0.00001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0001	0.0001	0.00001	0.00002	0.0000	0.00002	No
Titanium	120	0.035139	0.036017	0.260524	0.095989	0.065776	0.063959	0.058689	0.550131	0.034328	0.040151	0.212185	0.169083	0.042689	0.052968	0.116042	0.077374	No
Uranium	0.1	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
Vanadium	1	0.0012922	0.001324	0.0095806	0.0035299	0.0024189	0.0023521	0.002158	0.020231	0.001262	0.001477	0.007803	0.006218	0.001570	0.001948	0.004267	0.002845	No
Yttrium	—	0.00009537	0.0000978	0.0007071	0.0002605	0.0001785	0.0001736	0.0001593	0.0014932	0.0000932	0.0001090	0.0005759	0.0004589	0.0001159	0.0001438	0.0003150	0.0002100	No
Zinc	120	0.0010	0.0010	0.0075	0.0028	0.0019	0.0018	0.0017	0.016	0.0010	0.0012	0.006	0.005	0.0012	0.002	0.003	0.0022	No

Notes:

All values are in µg/m³, unless otherwise noted.

— = Value not available.

Shaded + Bold = Exceeds 24-hour Screening Threshold

(a) 8-hour.

Table 12: Screening of 24-hour Maximum Predicted Metal Concentrations (Expansion Project)

Parameter	Selected 24-hour Screening Threshold (µg/m³)	Maximum Predicted 24-hour Concentration (µg/m³)															Retain for 24-hour Inhalation Assessment?
		Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Aluminum	—	6.716E-01	6.746E-01	4.789E+00	1.665E+00	1.330E+00	1.313E+00	1.187E+00	1.206E+01	6.529E-01	7.930E-01	4.064E+00	2.526E+00	7.624E-01	8.952E-01	1.961E+00	1.388E+00	No
Antimony	25	3.799E-05	3.816E-05	2.709E-04	9.415E-05	7.520E-05	7.427E-05	6.712E-05	6.823E-04	3.693E-05	4.485E-05	2.299E-04	1.429E-04	4.312E-05	5.064E-05	1.109E-04	7.853E-05	No
Arsenic	0.015[(a)]	1.077E-03	1.082E-03	7.682E-03	2.670E-03	2.133E-03	2.106E-03	1.903E-03	**1.935E-02**	1.047E-03	1.272E-03	6.519E-03	4.051E-03	1.223E-03	1.436E-03	3.145E-03	2.227E-03	**Yes**
Barium	10	3.793E-03	3.811E-03	2.705E-02	9.403E-03	7.510E-03	7.417E-03	6.703E-03	6.813E-02	3.688E-03	4.479E-03	2.296E-02	1.427E-02	4.306E-03	5.057E-03	1.108E-02	7.843E-03	No
Beryllium	0.01	7.061E-06	7.093E-06	5.035E-05	1.750E-05	1.398E-05	1.380E-05	1.248E-05	1.268E-04	6.864E-06	8.338E-06	4.273E-05	2.655E-05	8.015E-06	9.412E-06	2.062E-05	1.460E-05	No
Bismuth	—	1.940E-06	1.949E-06	1.384E-05	4.809E-06	3.841E-06	3.793E-06	3.428E-06	3.485E-05	1.886E-06	2.291E-06	1.174E-05	7.297E-06	2.203E-06	2.586E-06	5.665E-06	4.011E-06	No
Cadmium	0.025	2.582E-06	2.594E-06	1.841E-05	6.401E-06	5.112E-06	5.049E-06	4.563E-06	4.638E-05	2.510E-06	3.049E-06	1.563E-05	9.712E-06	2.931E-06	3.442E-06	7.540E-06	5.339E-06	No
Calcium	—	3.834E-01	3.852E-01	2.734E+00	9.504E-01	7.591E-01	7.497E-01	6.775E-01	6.887E+00	3.728E-01	4.528E-01	2.320E+00	1.442E+00	4.353E-01	5.111E-01	1.120E+00	7.927E-01	No
Chromium	0.1	1.613E-03	1.621E-03	1.150E-02	3.999E-03	3.194E-03	3.154E-03	2.851E-03	2.898E-02	1.568E-03	1.905E-03	9.763E-03	6.067E-03	1.831E-03	2.151E-03	4.711E-03	3.335E-03	No
Cobalt	0.1	2.599E-04	2.611E-04	1.854E-03	6.443E-04	5.146E-04	5.082E-04	4.593E-04	4.669E-03	2.527E-04	3.069E-04	1.573E-03	9.775E-04	2.951E-04	3.465E-04	7.590E-04	5.374E-04	No
Copper	50	6.876E-04	6.907E-04	4.903E-03	1.704E-03	1.361E-03	1.344E-03	1.215E-03	1.235E-02	6.684E-04	8.119E-04	4.161E-03	2.586E-03	7.805E-04	9.165E-04	2.008E-03	1.421E-03	No
Gold	—	7.512E-07	7.546E-07	5.357E-06	1.862E-06	1.487E-06	1.469E-06	1.327E-06	1.349E-05	7.303E-07	8.870E-07	4.546E-06	2.825E-06	8.527E-07	1.001E-06	2.193E-06	1.553E-06	No
Iron	4	7.374E-01	7.407E-01	**5.258E+00**	1.828E+00	1.460E+00	1.442E+00	1.303E+00	**1.324E+01**	7.169E-01	8.707E-01	**4.462E+00**	2.773E+00	8.371E-01	9.829E-01	2.153E+00	1.524E+00	**Yes**
Lead	0.5	1.159E-04	1.164E-04	8.263E-04	2.872E-04	2.294E-04	2.265E-04	2.047E-04	2.081E-03	1.126E-04	1.368E-04	7.012E-04	4.358E-04	1.315E-04	1.545E-04	3.383E-04	2.395E-04	No
Lithium	20	3.136E-04	3.150E-04	2.236E-03	7.774E-04	6.209E-04	6.132E-04	5.542E-04	5.633E-03	3.049E-04	3.703E-04	1.898E-03	1.180E-03	3.560E-04	4.181E-04	9.158E-04	6.484E-04	No
Magnesium	—	2.034E-01	2.043E-01	1.450E+00	5.041E-01	4.027E-01	3.977E-01	3.594E-01	3.653E+00	1.977E-01	2.402E-01	1.231E+00	7.649E-01	2.309E-01	2.711E-01	5.939E-01	4.205E-01	No
Manganese	0.1	7.645E-03	7.680E-03	5.452E-02	1.895E-02	1.514E-02	1.495E-02	1.351E-02	**1.373E-01**	7.433E-03	9.028E-03	4.627E-02	2.875E-02	8.679E-03	1.019E-02	2.232E-02	1.581E-02	**Yes**
Molybdenum	120	1.164E-05	1.169E-05	8.300E-05	2.885E-05	2.304E-05	2.276E-05	2.057E-05	2.091E-04	1.132E-05	1.374E-05	7.044E-05	4.377E-05	1.321E-05	1.552E-05	3.399E-05	2.406E-05	No
Nickel	0.06[(a)]	6.743E-04	6.774E-04	4.809E-03	1.671E-03	1.335E-03	1.318E-03	1.192E-03	1.211E-02	6.556E-04	7.963E-04	4.081E-03	2.536E-03	7.655E-04	8.989E-04	1.969E-03	1.394E-03	No
Potassium	—	1.287E-01	1.293E-01	9.177E-01	3.190E-01	2.548E-01	2.516E-01	2.274E-01	2.311E+00	1.251E-01	1.520E-01	7.788E-01	4.840E-01	1.461E-01	1.715E-01	3.758E-01	2.661E-01	No
Selenium	10	1.161E-05	1.166E-05	8.279E-05	2.878E-05	2.299E-05	2.270E-05	2.052E-05	2.085E-04	1.129E-05	1.371E-05	7.026E-05	4.367E-05	1.318E-05	1.548E-05	3.390E-05	2.400E-05	No
Silver	1	2.857E-06	2.870E-06	2.037E-05	7.081E-06	5.656E-06	5.586E-06	5.048E-06	5.132E-05	2.778E-06	3.374E-06	1.729E-05	1.074E-05	3.243E-06	3.808E-06	8.342E-06	5.907E-06	No
Sodium	—	1.537E-01	1.544E-01	1.096E+00	3.810E-01	3.043E-01	3.005E-01	2.716E-01	2.761E+00	1.494E-01	1.815E-01	9.302E-01	5.781E-01	1.745E-01	2.049E-01	4.488E-01	3.178E-01	No
Strontium	120	2.054E-03	2.063E-03	1.465E-02	5.091E-03	4.066E-03	4.016E-03	3.629E-03	3.689E-02	1.997E-03	2.425E-03	1.243E-02	7.725E-03	2.332E-03	2.738E-03	5.998E-03	4.247E-03	No
Thallium	—	2.966E-06	2.980E-06	2.115E-05	7.352E-06	5.873E-06	5.800E-06	5.241E-06	5.328E-05	2.884E-06	3.503E-06	1.795E-05	1.116E-05	3.367E-06	3.954E-06	8.662E-06	6.133E-06	No
Tin	10	1.046E-05	1.050E-05	7.457E-05	2.592E-05	2.070E-05	2.045E-05	1.848E-05	1.878E-04	1.017E-05	1.235E-05	6.328E-05	3.933E-05	1.187E-05	1.394E-05	3.053E-05	2.162E-05	No
Titanium	120	3.382E-02	3.397E-02	2.412E-01	8.382E-02	6.695E-02	6.612E-02	5.975E-02	6.074E-01	3.288E-02	3.993E-02	2.047E-01	1.272E-01	3.839E-02	4.508E-02	9.875E-02	6.991E-02	No
Uranium	0.1	9.436E-06	9.479E-06	6.729E-05	2.339E-05	1.868E-05	1.845E-05	1.667E-05	1.695E-04	9.174E-06	1.114E-05	5.711E-05	3.549E-05	1.071E-05	1.258E-05	2.755E-05	1.951E-05	No
Vanadium	1	1.244E-03	1.249E-03	8.868E-03	3.082E-03	2.462E-03	2.431E-03	2.197E-03	2.234E-02	1.209E-03	1.468E-03	7.526E-03	4.677E-03	1.412E-03	1.658E-03	3.631E-03	2.571E-03	No
Yttrium	—	9.179E-05	9.220E-05	6.545E-04	2.275E-04	1.817E-04	1.795E-04	1.622E-04	1.649E-03	8.923E-05	1.084E-04	5.555E-04	3.452E-04	1.042E-04	1.224E-04	2.680E-04	1.898E-04	No
Zinc	120	9.709E-04	9.753E-04	6.924E-03	2.407E-03	1.922E-03	1.898E-03	1.716E-03	1.744E-02	9.439E-04	1.146E-03	5.876E-03	3.651E-03	1.102E-03	1.294E-03	2.835E-03	2.007E-03	No

Notes:

All values are in µg/m³, unless otherwise noted.

— = Value not available.

Shaded + Bold = Exceeds 24-hour Screening Threshold

(a) 8-hour.

Table 13: Annual Metals Screening Thresholds

Parameter		NDOE[a]	CCME NAAQO[b]			MOE[c]	ATSDR[d]	OEHHA[e][f]	WHO[g]	TCEQ[h]	Toxicological Endpoints and Derivations
			Desirable	Acceptable	Tolerable						
Aluminum		—	—	—	—	—	—	—	—	**3 (5)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for metal and insoluble aluminum
Antimony		—	—	—	—	—	—	—	—	**0.3 (0.5)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction
Arsenic	Non-carcinogenic	—	—	—	—	—	—	0.003 (0.015)	—	0.05 (0.067)	OEHHA - Based on a LOAEL of 0.23 µg/m^3 for decrease in intellectual function and adverse effects on neurobehavioural development in children. An uncertainty factor of 30 was applied; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for arsenic inorganic compounds.
	Carcinogenic	—	—	—	—	—	—	**0.003**	0.0067	—	OEHHA - Based on the 95% upper confidence limit of cancer incidence predicted from fitting a linear model to human data, adjusted for interaction with smoking. WHO - Derived from lung cancer in human studies. Based on a lifetime risk level of 1:1000000.
Barium		—	—	—	—	—	—	—	—	**0.3 (0.5)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction
Beryllium	Non-carcinogenic	—	—	—	—	—	—	0.0014 (0.007)	—	**0.001 (0.002)**	OEHHA - Based on beryllium sensitization and chronic beryllium disease in occupationally exposed humans. A LOAEL of 0.55 µg/m^3 for the above effects was selected. The LOAEL was adjusted for duration and an uncertainty factor of 30 was applied; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for beryllium particulate.
	Carcinogenic	—	—	—	—	—	—	0.0042	—	—	OEHHA - Based on lung cancer in occupationally exposed human males
Bismuth		—	—	—	—	—	—	—	—	**3 (5)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction
Cadmium	Non-carcinogenic	—	—	—	—	0.001 (0.005)	0.002 (0.01)	0.004 (0.02)	0.001 (0.005)	0.007 (0.01)	MOE - health; ATSDR - Based on creatinine in the urine; OEHHA - Based on a NOAEL of 1.4 µg/m^3 for kidney and respiratory effects. The NOAEL was adjusted for exposure duration and an uncertainty factor of 30 was applied. WHO - Based on renal effects; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction.
	Carcinogenic	—	—	—	—	—	—	**0.0002**	—	—	OEHHA - Based on human occupational exposures and lung cancer
Calcium		—	—	—	—	—	—	—	—	**1 (2)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for calcium oxide
Chromium		—	—	—	—	—	—	—	—	**0.027 (0.041)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for chromium (III) compounds
Cobalt		—	—	—	—	—	0.02 (0.1)	—	—	**0.013 (0.02)**	ATSDR - Based on a NOAEL of 0.0053 mg/m^3 for pulmonary function effects. The NOAEL was adjusted for duration and an uncertainty factor of 10 was applied; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction.
Copper		—	—	—	—	—	—	—	—	**0.7 (1)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for copper dusts and mists
Gold		—	—	—	—	—	—	—	—	**1.7 (2.5)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction
Iron		—	—	—	—	—	—	—	—	**0.7 (1)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, as soluble iron salts
Lead	Non-carcinogenic	—	—	—	—	**0.04 (0.2(i))**	—	—	0.1 (0.5)	—	MOE - health; WHO - Based on the concentration of lead in blood. Critical effects occur in adults at 150 to 300 µg/L and include erythrocyte protoporphyrin elevation. Critical effects in children include cognitive deficit, hearing impairment and affected vitamin D metabolism at 100 to 150 µg/L.
	Carcinogenic	—	—	—	—	—	—	0.833	—	—	OEHHA - Based on kidney tumours in rats exposed to lead via the oral route
Lithium		—	—	—	—	—	—	—	—	**0.1 (0.2)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for lithium inorganic compounds
Magnesium		—	—	—	—	—	—	—	—	**3 (4)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, magnesium nitrate (as Mg)
Manganese		—	—	—	—	—	0.06 (0.3)	**0.018 (0.09)**	0.03 (0.15)	0.1 (0.2)	ATSDR - Based on abnormal eye-hand coordination scores in workers. Adjusted for duration and an uncertainty factor of 100 was applied. OEHHA - Based on a benchmark concentration of 72 µg/m^3 for impaired neurobehaviour (visual reaction time, eye-hand coordination and hand steadiness). The benchmark concentration was adjusted for duration and an uncertainty factor of 300 was applied. WHO - A NOAEL of 30 µg/m^3 for neurotoxic effects was selected as the basis of the WHO threshold. The NOAEL was adjusted for exposure duration and an uncertainty factor of 50 was applied; TCEQ - health effects for chemical present as particulate matter, PM10 fraction, manganese metal & compounds.
Molybdenum		—	—	—	—	—	—	—	—	**2 (3)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction

Table 13: Annual Metals Screening Thresholds

Parameter	NDOE[a]	CCME NAAQO[b]			MOE[c]	ATSDR[d]	OEHHA[e][f]	WHO[g]	TCEQ[h]	Toxicological Endpoints and Derivations
		Desirable	Acceptable	Tolerable						
Nickel — Non-carcinogenic	—	—	—	—	0.004 (0.02)	0.018 (0.09)	**0.0028 (0.014)**	—	0.04 (0.059)	MOE - health effects for chemical present as particulate matter, PM_{10} fraction; ATSDR - Based on a NOAEL of 0.03 mg/m^3 for chronic active inflammation and lung fibrosis in rats. The LOAEL was adjusted for exposure duration and an uncertainty factor of 30 was applied. OEHHA - Based on a BMDL05 of 30.5 $\mu g/m^3$ for pathological changes in lung, lymph nodes and nasal epithelium, adjusted for exposure duration and an uncertainty factor of 100 was applied; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for nickel metal and compounds.
Nickel — Carcinogenic	—	—	—	—	—	—	0.0385	0.025	—	OEHHA - Based on a study that demonstrated an increased risk of lung cancer in occupationally-exposed humans. WHO - Based on lung cancer in human studies associated with a lifetime risk of 1: 1000000.
Potassium	—	—	—	—	—	—	—	—	**1 (2)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction
Selenium	—	—	—	—	—	—	4 (20)	—	**0.1 (0.2)**	OEHHA - Based on a NOAEL of 0.015 mg/kg/day. The NOAEL was adjusted with an uncertainty factor of 3 and extrapolated to an inhalation threshold; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction.
Silver	—	—	—	—	—	—	—	—	**0.007 (0.01)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, silver metal & compounds
Sodium	—	—	—	—	—	—	—	—	**1 (2)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, for sodium oxide
Strontium	—	—	—	—	—	—	—	—	**1 (2)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, strontium & compounds
Thallium	—	—	—	—	—	—	—	—	**0.07 (0.1)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, thallium & compounds
Tin	—	—	—	—	—	—	—	—	**1 (2)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, tin inorganic compounds
Titanium	—	—	—	—	—	—	—	—	**3 (5)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, titanium
Uranium	—	—	—	—	**0.006 (0.03)**	0.02 (0.1)	—	—	0.1 (0.2)	MOE - health effects for chemical present as particulate matter, PM_{10} fraction; ATSDR - For soluble uranium salts based on renal toxicity in dogs, adjusted for exposure duration and an uncertainty factor of 100 was applied; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, elemental uranium.
Vanadium	—	—	—	—	—	**0.02 (0.1)**	—	—	1 (2)	ATSDR - Based on degeneration of respiratory epithelium of the epiglottis in rats. Adjusted for intermittent exposure and an uncertainty factor of 30 was applied; TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction, vanadium metals and compounds.
Yttrium	—	—	—	—	—	—	—	—	**0.7 (1)**	TCEQ - health effects for chemical present as particulate matter, PM_{10} fraction
Zinc	—	—	—	—	—	—	—	—	**1 (2)**	TCEQ - health effects for zinc & compounds

Table 13: Annual Metals Screening Thresholds

Parameter	NDOE[a]	CCME NAAQO[b]			MOE[c]	ATSDR[d]	OEHHA[e][f]	WHO[g]	TCEQ[h]	Toxicological Endpoints and Derivations
		Desirable	Acceptable	Tolerable						

Notes:

All values are in µg/m^3, unless otherwise noted.

All guideline values are for non-carcinogens, unless otherwise noted.

The screening levels derived by MOE, ATSDR, CalEPA, and WHO are based on an HQ=1.0 for non-carcinogens. The non-carcinogenic thresholds for metals were divided by 5 to adjust for a final target HQ of 0.2. The original values are provided in brackets.

The screening levels derived by TCEQ are based on an HQ=0.3 for non-carcinogens. These guidelines have been adjusted to a HQ=0.2 for comparison to other guidelines with the following equation: threshold (µg/m^3) = TCEQ value x 3.333/5. The original values are provided in brackets.

Chemical-specific inhalation unit risks were used to derive carcinogenic thresholds. An ILCR of 10^{-5} was assumed in calculating thresholds from Inhalation Unit Risk factors.

HQ = hazard quotient; ILCR = incremental lifetime cancer risk; LOAEL = Lowest Observed Adverse Effect Level; µg/L = microgram per litre; µg/m^3 = microgram per cubic metre; Mg = magnesium; mg/kg/day = milligram per kilogram per day; mg/m^3 = milligram per cubic metre; NOAEL = no observable adverse effect level; PM = Particulate matter; ppm = parts per million; REL = reference exposure level.

— = Value not available.

Shaded + Bold = Screening threshold selected for use in the assessment is the NDOE threshold. In the absence of an NDOE threshold, the most conservative threshold from all other jurisdictions is selected.

[a] Government of Nunavut Department of Environment (NDOE), Ambient Air Quality Standards. In: Environmental Guideline for Ambient Air Quality (October 2011).

[b] Canadian Council of Ministers of the Environment (CCME), Canadian national ambient air quality objectives - Process and status. In - Canadian environmental quality guidelines (1999).

[c] Ontario Ministry of the Environment (MOE), Ontario's Ambient Air Quality Criteria. Standards Development Branch, MOE. (April, 2012).

[d] Agency of Toxic Substances and Disease Registry (ATSDR), Minimum Risk Levels (MRLs), October 2015 and supporting toxicological profiles.

[e] California Office of Environmental Health Hazard Assessment (OEHHA), Air Toxicology and Epidemiology. Acute, 8-hour and Chronic Reference Exposure Levels (January 2014).

[f] California Office of Environmental Health Hazard Assessment (OEHHA), 2012, Toxicity Criteria Database.

[g] World Health Organization (WHO), Air Quality Guidelines for Europe. Second Edition. WHO Regional Publications, European Series, No. 91 (2000).

[h] Texas Commission on Environmental Quality (TCEQ), Interoffice memorandum, Effects Screening Levels (September 2015). Guideline was provided from TCEQ if values were not available from any of the other jurisdications.

[i] 30 days.

Table 14: Screening of Annual Predicted Metal Concentrations (Approved Project)

Parameter		Selected Annual Screening Threshold (µg/m³)	Maximum Predicted Annual Concentration (µg/m³)															Retain for Annual Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Aluminum		3	0.258989	0.256309	0.344894	0.358629	0.269440	0.268263	0.266559	1.299824	0.260760	0.265571	0.373527	0.334537	0.261143	0.268124	0.354055	0.298273	No
Antimony		0.3	0.0000146	0.0000145	0.0000195	0.0000203	0.00001524	0.0000152	0.000015	0.0000735	0.00001475	0.00001502	0.0000211	0.0000189	0.000015	0.000015	0.000020	0.0000169	No
Arsenic	Carcinogenic	0.003	0.00041542	0.00041112	0.0005532	0.0005752	0.00043219	0.00043030	0.0004276	0.0020849	0.00041826	0.00042598	0.0005991	0.0005366	0.000419	0.0004301	0.000568	0.0004784	No
Barium		0.3	0.0014629	0.0014478	0.0019481	0.0020257	0.00152194	0.00151529	0.0015057	0.0073421	0.00147291	0.00150008	0.0021099	0.0018896	0.0014751	0.0015145	0.002000	0.0016848	No
Beryllium		0.001	0.00000272	0.00000269	0.0000036	0.0000038	0.00000283	0.00000282	0.0000028	0.0000137	0.00000274	0.00000279	0.0000039	0.0000035	0.0000027	0.0000028	0.000004	0.0000031	No
Bismuth		3	0.000001	0.0000007	0.000001	0.000001	0.0000008	0.0000008	0.000001	0.000004	0.0000008	0.0000008	0.000001	0.000001	0.00000	0.000001	0.00000	0.000001	No
Cadmium	Carcinogenic	0.0002	0.000001	0.000001	0.00000	0.00000	0.000001	0.000001	0.00000	0.00000	0.000001	0.000001	0.00000	0.00000	0.0000	0.00000	0.0000	0.00000	No
Calcium		1	0.147867	0.146336	0.19691	0.20476	0.153834	0.153162	0.15219	0.74212	0.148878	0.151624	0.21326	0.19100	0.14910	0.15308	0.2021	0.17030	No
Chromium		0.027	0.000622	0.000616	0.00083	0.00086	0.000647	0.000644	0.00064	0.00312	0.000626	0.000638	0.00090	0.00080	0.0006	0.00064	0.0009	0.00072	No
Cobalt		0.013	0.00010	0.00010	0.0001	0.00014	0.00010	0.00010	0.0001	0.0005	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	No
Copper		0.7	0.000265	0.000262	0.00035	0.000367	0.000276	0.000275	0.00027	0.00133	0.000267	0.000272	0.00038	0.00034	0.00027	0.00027	0.00036	0.00031	No
Gold		1.7	0.00000029	0.00000029	0.0000004	0.00000040	0.00000030	0.00000030	0.0000003	0.0000015	0.00000029	0.00000030	0.0000004	0.0000004	0.0000003	0.0000003	0.0000004	0.0000003	No
Iron		0.7	0.28435748	0.28141443	0.3786774	0.39375749	0.29583251	0.29453960	0.2926690	**1.4271437**	0.28630178	0.29158363	0.4101146	0.3673057	0.2867229	0.2943868	0.3887356	0.3274894	No[(b)]
Lead		0.04[(a)]	0.0000447	0.0000442	0.000060	0.000062	0.0000465	0.0000463	0.000046	0.000224	0.0000450	0.0000458	0.000064	0.000058	0.000045	0.000046	0.00006	0.000051	No
Lithium		0.1	0.000121	0.000120	0.00016	0.000167	0.000126	0.000125	0.00012	0.00061	0.000122	0.000124	0.00017	0.00016	0.00012	0.00013	0.00017	0.00014	No
Magnesium		3	0.078436	0.077624	0.10445	0.108612	0.081601	0.081245	0.08073	0.39366	0.078972	0.080429	0.11312	0.10132	0.07909	0.08120	0.10723	0.09033	No
Manganese		0.018	0.002948	0.002918	0.00393	0.004083	0.003067	0.003054	0.00303	0.01480	0.002968	0.003023	0.00425	0.00381	0.00297	0.00305	0.00403	0.00340	No
Molybdenum		2	0.000004	0.000004	0.00001	0.00001	0.000005	0.000005	0.00000	0.00002	0.000005	0.000005	0.00001	0.00001	0.0000	0.00000	0.0000	0.00001	No
Nickel		0.0028	0.0002601	0.0002574	0.000346	0.000360	0.0002706	0.0002694	0.000268	0.001305	0.0002618	0.0002667	0.000375	0.000336	0.000262	0.00027	0.00036	0.000300	No
Potassium		1	0.0496271	0.0491135	0.066088	0.0687200	0.0516298	0.0514041	0.051078	0.249070	0.0499664	0.0508882	0.071575	0.064104	0.050040	0.051377	0.067844	0.057155	No
Selenium		0.1	0.000004	0.000004	0.00001	0.00001	0.000005	0.000005	0.00000	0.00002	0.000005	0.000005	0.00001	0.00001	0.0000	0.00000	0.0000	0.00001	No
Silver		0.007	0.0000011	0.0000011	0.000001	0.000002	0.0000011	0.0000011	0.000001	0.000006	0.0000011	0.0000011	0.000002	0.000001	0.00000	0.000001	0.00000	0.000001	No
Sodium		1	0.0593	0.0587	0.0789	0.0821	0.06167	0.0614	0.061	0.2975	0.0597	0.0608	0.0855	0.077	0.060	0.061	0.081	0.0683	No
Strontium		1	0.0007921	0.0007839	0.0010549	0.0010969	0.0008241	0.0008205	0.000815	0.0039755	0.0007975	0.0008123	0.001142	0.001023	0.000799	0.000820	0.001083	0.0009123	No
Thallium		0.07	0.0000011439	0.0000011321	0.000001523	0.000001584	0.0000011901	0.0000011849	0.000001177	0.000005741	0.0000011518	0.0000011730	0.000001650	0.000001478	0.00000115	0.000001184	0.00000156	0.000001317	No
Tin		1	0.000004	0.000004	0.00001	0.00001	0.000004	0.000004	0.00000	0.00002	0.000004	0.000004	0.00001	0.00001	0.00000	0.00000	0.0000	0.00000	No
Titanium		3	0.013041	0.012906	0.01737	0.01806	0.013568	0.013508	0.01342	0.06545	0.013131	0.013373	0.01881	0.01685	0.0131	0.01350	0.0178	0.01502	No
Uranium		0.006	0.0000036	0.0000036	0.000005	0.000005	0.0000038	0.0000038	0.000004	0.000018	0.0000037	0.0000037	0.000005	0.000005	0.00000	0.000004	0.00000	0.000004	No
Vanadium		0.02	0.00047959	0.00047463	0.0006387	0.0006641	0.00049894	0.00049676	0.0004936	0.0024070	0.00048287	0.00049178	0.0006917	0.0006195	0.0004836	0.0004965	0.000656	0.0005523	No
Yttrium		0.7	0.0000354	0.0000350	0.000047	0.000049	0.0000368	0.0000367	0.000036	0.000178	0.0000356	0.0000363	0.000051	0.000046	0.000036	0.000037	0.00005	0.000041	No
Zinc		1	0.00037	0.00037	0.0005	0.0005	0.00039	0.00039	0.0004	0.0019	0.00038	0.00038	0.0005	0.0005	0.0004	0.0004	0.0005	0.0004	No

Notes:

All values are in µg/m³, unless otherwise noted.

— = Value not available.

Shaded + Bold = Exceeds Annual Screening Threshold

(a) 30 days.

Attachment B-1: Air Quality Screening Tables

Table 15: Screening of Annual Predicted Metal Concentrations (Expansion Project)

Parameter		Selected Annual Screening Threshold (µg/m³)	Maximum Predicted Annual Concentration (µg/m³)															Retain for Annual Inhalation Assessment?
			Grave Site 2	Grave Site 3	Grave Site 4	Grave Site 5	Grave Site 27	Grave Site 28	Grave Site 29	Grave Site 30	Fishing Marker	Muskox	Muskox	To Iglu	Fishing Area	Caching Area	Track	Caching	
Aluminum		3	0.259466	0.257425	0.346457	0.355781	0.270416	0.269021	0.267322	1.485099	0.260186	0.266668	0.384081	0.334240	0.261213	0.267708	0.340854	0.295867	No
Antimony		0.3	0.0000147	0.0000146	0.0000196	0.0000201	0.00001530	0.0000152	0.000015	0.0000840	0.00001472	0.00001508	0.0000217	0.0000189	0.000015	0.000015	0.000019	0.0000167	No
Arsenic	Carcinogenic	0.003	0.00041619	0.00041291	0.0005557	0.0005707	0.00043375	0.00043151	0.0004288	0.0023821	0.00041734	0.00042774	0.0006161	0.0005361	0.000419	0.0004294	0.000547	0.0004746	No
Barium		0.3	0.0014656	0.0014541	0.0019570	0.0020096	0.00152745	0.00151957	0.0015100	0.0083886	0.00146967	0.00150628	0.0021695	0.0018880	0.0014755	0.0015122	0.001925	0.0016712	No
Beryllium		0.001	0.00000273	0.00000271	0.0000036	0.0000037	0.00000284	0.00000283	0.0000028	0.0000156	0.00000274	0.00000280	0.0000040	0.0000035	0.0000027	0.0000028	0.000004	0.0000031	No
Bismuth		3	0.000001	0.0000007	0.000001	0.000001	0.0000008	0.0000008	0.000001	0.000004	0.0000008	0.0000008	0.000001	0.000001	0.00000	0.000001	0.00000	0.000001	No
Cadmium	Carcinogenic	0.0002	0.000001	0.000001	0.00000	0.00000	0.000001	0.000001	0.00000	0.00001	0.000001	0.000001	0.00000	0.00000	0.0000	0.00000	0.0000	0.00000	No
Calcium		1	0.148139	0.146974	0.19781	0.20313	0.154391	0.153594	0.15262	0.84790	0.148550	0.152251	0.21929	0.19083	0.14914	0.15284	0.1946	0.16892	No
Chromium		0.027	0.000623	0.000618	0.00083	0.00085	0.000650	0.000646	0.00064	0.00357	0.000625	0.000641	0.00092	0.00080	0.0006	0.00064	0.0008	0.00071	No
Cobalt		0.001	0.00010	0.00010	0.0001	0.00014	0.00010	0.00010	0.0001	0.0006	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	No
Copper		0.7	0.000266	0.000264	0.00035	0.000364	0.000277	0.000275	0.00027	0.00152	0.000266	0.000273	0.00039	0.00034	0.00027	0.00027	0.00035	0.00030	No
Gold		1.7	0.00000029	0.00000029	0.0000004	0.00000040	0.00000030	0.00000030	0.0000003	0.0000017	0.00000029	0.00000030	0.0000004	0.0000004	0.0000003	0.0000003	0.0000004	0.0000003	No
Iron		0.7	0.28488118	0.28264045	0.3803929	0.39063050	0.29690423	0.29537190	0.2935066	**1.6305672**	0.28567167	0.29278912	0.4217028	0.3669796	0.2867989	0.2939300	0.3742408	0.3248481	No[(b)]
Lead		0.04[(a)]	0.0000448	0.0000444	0.000060	0.000061	0.0000467	0.0000464	0.000046	0.000256	0.0000449	0.0000460	0.000066	0.000058	0.000045	0.000046	0.00006	0.000051	No
Lithium		0.1	0.000121	0.000120	0.00016	0.000166	0.000126	0.000126	0.00012	0.00069	0.000122	0.000125	0.00018	0.00016	0.00012	0.00013	0.00016	0.00014	No
Magnesium		3	0.078580	0.077962	0.10493	0.107750	0.081897	0.081474	0.08096	0.44977	0.078799	0.080762	0.11632	0.10123	0.07911	0.08108	0.10323	0.08960	No
Manganese		0.018	0.002954	0.002930	0.00394	0.004050	0.003078	0.003063	0.00304	0.01691	0.002962	0.003036	0.00437	0.00380	0.00297	0.00305	0.00388	0.00337	No
Molybdenum		0.08	0.000004	0.000004	0.00001	0.00001	0.000005	0.000005	0.00000	0.00003	0.000005	0.000005	0.00001	0.00001	0.0000	0.00000	0.0000	0.00001	No
Nickel		0.0028	0.0002605	0.0002585	0.000348	0.000357	0.0002715	0.0002701	0.000268	0.001491	0.0002613	0.0002678	0.000386	0.000336	0.000262	0.00027	0.00034	0.000297	No
Potassium		1	0.0497185	0.0493275	0.066388	0.0681743	0.0518168	0.0515494	0.051224	0.284573	0.0498565	0.0510986	0.073597	0.064047	0.050053	0.051298	0.065314	0.056694	No
Selenium		0.1	0.000004	0.000004	0.00001	0.00001	0.000005	0.000005	0.00000	0.00003	0.000004	0.000005	0.00001	0.00001	0.0000	0.00000	0.0000	0.00001	No
Silver		0.007	0.0000011	0.0000011	0.000001	0.000002	0.0000012	0.0000011	0.000001	0.000006	0.0000011	0.0000011	0.000002	0.000001	0.00000	0.000001	0.00000	0.000001	No
Sodium		1	0.0594	0.0589	0.0793	0.0814	0.06189	0.0616	0.061	0.3399	0.0596	0.0610	0.0879	0.076	0.060	0.061	0.078	0.0677	No
Strontium		1	0.0007936	0.0007873	0.0010596	0.0010882	0.0008271	0.0008228	0.000818	0.0045422	0.0007958	0.0008156	0.001175	0.001022	0.000799	0.000819	0.001043	0.0009049	No
Thallium		0.07	0.0000011460	0.0000011370	0.000001530	0.000001571	0.0000011944	0.0000011882	0.000001181	0.000006560	0.0000011492	0.0000011779	0.000001696	0.000001476	0.00000115	0.000001182	0.00000151	0.000001307	No
Tin		1	0.000004	0.000004	0.00001	0.00001	0.000004	0.000004	0.00000	0.00002	0.000004	0.000004	0.00001	0.00001	0.00000	0.00000	0.0000	0.00000	No
Titanium		3	0.013065	0.012963	0.01745	0.01792	0.013617	0.013547	0.01346	0.07478	0.013102	0.013428	0.01934	0.01683	0.0132	0.01348	0.0172	0.01490	No
Uranium		0.006	0.0000036	0.0000036	0.000005	0.000005	0.0000038	0.0000038	0.000004	0.000021	0.0000037	0.0000037	0.000005	0.000005	0.00000	0.000004	0.00000	0.000004	No
Vanadium		0.02	0.00048047	0.00047669	0.0006416	0.0006588	0.00050075	0.00049817	0.0004950	0.0027501	0.00048181	0.00049381	0.0007112	0.0006189	0.0004837	0.0004957	0.000631	0.0005479	No
Yttrium		0.7	0.0000355	0.0000352	0.000047	0.000049	0.0000370	0.0000368	0.000037	0.000203	0.0000356	0.0000364	0.000052	0.000046	0.000036	0.000037	0.00005	0.000040	No
Zinc		1	0.00038	0.00037	0.0005	0.0005	0.00039	0.00039	0.0004	0.0021	0.00038	0.00039	0.0006	0.0005	0.0004	0.0004	0.0005	0.0004	No

Notes:

All values are in µg/m³, unless otherwise noted.

— = Value not available.

Shaded + Bold = Exceeds Annual Screening Threshold

(a) 30 days.

(b) Iron was retained for the 24-hour predictions at Grave Site 30; given that the predicted concentrations were higher for the 24-hour modeling period than the annual modelling period, the 24-hour averaging time was used in the remainder of the RA to assess risks due to iron at this location.

ANNEX B-2

Soil Quality

Table 1: Predicted Soil Concentrations

Chemical	Baseline Soil Concentration [a] (mg/kg)	Approved Project - Dry Deposition Rate [b] ($g/m^2/yr$)	Approved Project - Wet Deposition Rate [b] ($g/m^2/yr$)	Approved Project - Incremental Soil Concentration [c] (mg/kg)	Approved Project - Predicted Soil Concentration [d] (mg/kg)	Expansion Project - Dry Deposition Rate [b] ($g/m^2/yr$)	Expansion Project - Wet Deposition Rate [b] ($g/m^2/yr$)	Expansion Project - Incremental Soil Concentration [c] (mg/kg)	Expansion Project - Predicted Soil Concentration [d] (mg/kg)
Metals									
Aluminum	9960	7.29E-02	1.38E-02	2.02E+01	9.98E+03	8.98E-01	4.05E-02	2.19E+02	1.02E+04
Antimony	0.10	4.12E-06	7.81E-07	1.14E-03	1.01E-01	5.08E-05	2.29E-06	1.24E-02	1.12E-01
Arsenic	13	1.17E-04	2.21E-05	3.25E-02	1.29E+01	1.44E-03	6.49E-05	3.51E-01	1.33E+01
Barium	87	4.12E-04	7.80E-05	1.14E-01	8.69E+01	5.08E-03	2.29E-04	1.24E+00	8.80E+01
Beryllium	0.54	7.67E-07	1.45E-07	2.13E-04	5.40E-01	9.45E-06	4.26E-07	2.30E-03	5.42E-01
Bismuth	0.30	2.11E-07	3.99E-08	5.85E-05	3.00E-01	2.60E-06	1.17E-07	6.33E-04	3.01E-01
Cadmium	0.06	2.80E-07	5.31E-08	7.78E-05	6.11E-02	3.45E-06	1.56E-07	8.42E-04	6.18E-02
Calcium	3620	4.16E-02	7.88E-03	1.16E+01	3.63E+03	5.13E-01	2.31E-02	1.25E+02	3.75E+03
Chromium	140	1.75E-04	3.32E-05	4.86E-02	1.40E+02	2.16E-03	9.72E-05	5.26E-01	1.41E+02
Cobalt	12	2.82E-05	5.34E-06	7.83E-03	1.16E+01	3.48E-04	1.57E-05	8.48E-02	1.17E+01
Copper	10	7.47E-05	1.41E-05	2.07E-02	1.01E+01	9.20E-04	4.14E-05	2.24E-01	1.03E+01
Gold	NM	8.16E-08	1.54E-08	2.26E-05	2.26E-05	1.00E-06	4.53E-08	2.45E-04	2.45E-04
Iron	21500	8.01E-02	1.52E-02	2.22E+01	2.15E+04	9.86E-01	4.44E-02	2.41E+02	2.17E+04
Lead	8	1.26E-05	2.38E-06	3.49E-03	7.92E+00	1.55E-04	6.98E-06	3.78E-02	7.96E+00
Lithium	12	3.41E-05	6.45E-06	9.45E-03	1.17E+01	4.20E-04	1.89E-05	1.02E-01	1.18E+01
Magnesium	8810	2.21E-02	4.18E-03	6.13E+00	8.82E+03	2.72E-01	1.23E-02	6.64E+01	8.88E+03
Manganese	450	8.30E-04	1.57E-04	2.30E-01	4.50E+02	1.02E-02	4.61E-04	2.49E+00	4.52E+02
Molybdenum	0.51	1.26E-06	2.39E-07	3.51E-04	5.10E-01	1.56E-05	7.02E-07	3.80E-03	5.14E-01
Nickel	63	7.32E-05	1.39E-05	2.03E-02	6.29E+01	9.02E-04	4.06E-05	2.20E-01	6.31E+01
Potassium	1890	1.40E-02	2.65E-03	3.88E+00	1.89E+03	1.72E-01	7.76E-03	4.20E+01	1.93E+03
Selenium	0.20	1.26E-06	2.39E-07	3.50E-04	2.00E-01	1.55E-05	7.00E-07	3.79E-03	2.04E-01
Silver	0.10	3.10E-07	5.87E-08	8.61E-05	1.00E-01	3.82E-06	1.72E-07	9.32E-04	1.01E-01
Sodium	113	1.67E-02	3.16E-03	4.63E+00	1.18E+02	2.06E-01	9.26E-03	5.01E+01	1.63E+02
Strontium	43	2.23E-04	4.22E-05	6.19E-02	4.27E+01	2.75E-03	1.24E-04	6.70E-01	4.33E+01
Thallium	0.11	3.22E-07	6.10E-08	8.94E-05	1.14E-01	3.97E-06	1.79E-07	9.68E-04	1.15E-01
Tin	2	1.14E-06	2.15E-07	3.15E-04	2.00E+00	1.40E-05	6.30E-07	3.41E-03	2.00E+00
Titanium	816	3.67E-03	6.95E-04	1.02E+00	8.17E+02	4.52E-02	2.04E-03	1.10E+01	8.27E+02
Uranium	3	1.02E-06	1.94E-07	2.84E-04	3.08E+00	1.26E-05	5.69E-07	3.08E-03	3.08E+00
Vanadium	25	1.35E-04	2.56E-05	3.75E-02	2.50E+01	1.66E-03	7.50E-05	4.06E-01	2.54E+01
Yttrium	NM	9.97E-06	1.89E-06	2.77E-03	2.77E-03	1.23E-04	5.53E-06	2.99E-02	2.99E-02
Zinc	41	1.05E-04	2.00E-05	2.93E-02	4.14E+01	1.30E-03	5.85E-05	3.17E-01	4.17E+01

Note:

$g/m^2/yr$ = gram per square metre per year; < = less than; $\mu g/m^2/s$ = microgram per square metre per second; mg/kg = milligram per kilogram; NM = not measured; a baseline value for this parameter was not measured, therefore, the predicted soil concentration is equal to the incremental soil concentration.

(a) Maximum measured baseline soil concentration.

(b) Maximum dry/wet deposition rate of all receptor locations.

(c) Maximum incremental soil concentration of all receptor locations.

(d) Calculated as the sum of the baseline soil concentration and the incremental soil concentration from particulate deposition.

Prepared by: SG

Checked by: AA

Table 2: Soil Deposition Screening for Human Health

Chemical	CCME SQG_{HH} [a] (mg/kg)	US EPA RSL [c] (mg/kg)	Baseline Soil Concentration [d] + 10% (mg/kg)	Approved Project			Expansion Project		
				Predicted Soil Concentration [e] (mg/kg)	Retained as a COPC?	Rationale	Predicted Soil Concentration [e] (mg/kg)	Retained as a COPC?	Rationale
Metals									
Aluminum	NV	15400	10956	9980	No	<RSL, <Baseline+10%	10179	No	<RSL, <Baseline+10%
Antimony	20 [f]	NA	0.11	0.10	No	<SQG, <Baseline+10%	0.11	No	<SQG, <Baseline+10%
Arsenic	12	NA	14	13	No	<SQG, <Baseline+10%	13	No	>SQG, <Baseline+10%
Barium	500	NA	95	87	No	<SQG, <Baseline+10%	88	No	<SQG, <Baseline+10%
Beryllium	550 [g]	NA	0.6	0.5	No	<SQG, <Baseline+10%	0.5	No	<SQG, <Baseline+10%
Bismuth	NV	NV	NR	0.30	No	NV	0.30	No	NV
Cadmium	14	NA	0.07	0.06	No	<SQG, <Baseline+10%	0.06	No	<SQG, <Baseline+10%
Calcium	NV	NV	3982	3632	No	<Baseline+10%	3745	No	<Baseline+10%
Chromium	220	NA	154	140	No	>SQG, <Baseline+10%	141	No	>SQG, <Baseline+10%
Cobalt	50 [f]	NA	13	12	No	<SQG, <Baseline+10%	12	No	<SQG, <Baseline+10%
Copper	1100	NA	11	10	No	<SQG, <Baseline+10%	10	No	<SQG, <Baseline+10%
Gold	NV	NV	NR	0.000023	No	NV	0.000245	No	NV
Iron	NV	11000	23650	21522	No	<RSL, <Baseline+10%	21741	No	>RSL, <Baseline+10%
Lead	140	NA	9	8	No	<SQG, <Baseline+10%	8	No	<SQG, <Baseline+10%
Lithium	NV	32	13	12	No	<RSL, <Baseline+10%	12	No	<RSL, <Baseline+10%
Magnesium	NV	NV	9691	8816	No	<Baseline+10%	8876	No	<Baseline+10%
Manganese	NV	360	495	450	No	>RSL, <Baseline+10%	452	No	>RSL, <Baseline+10%
Molybdenum	10 [f]	NA	0.56	0.51	No	<SQG, <Baseline+10%	0.51	No	<SQG, <Baseline+10%
Nickel	50 [h]	NA	69	63	No	<SQG, <Baseline+10%	63	No	>SQG, <Baseline+10%
Potassium	NV	NV	2079	1894	No	<Baseline+10%	1932	No	<Baseline+10%
Selenium	80	NA	0.22	0.20	No	<SQG, <Baseline+10%	0.20	No	<SQG, <Baseline+10%
Silver	20 [f]	NA	0.11	0.10	No	<SQG, <Baseline+10%	0.10	No	<SQG, <Baseline+10%
Sodium	NV	NV	124	118	No	<Baseline+10%	**163**	No (see text)	>Baseline+10%
Strontium	NV	9400	47	43	No	<RSL, <Baseline+10%	43	No	<RSL, <Baseline+10%
Thallium	1	NA	0.13	0.11	No	<SQG, <Baseline+10%	0.11	No	<SQG, <Baseline+10%
Tin	50 [f]	NA	2	2	No	<SQG, <Baseline+10%	2	No	<SQG, <Baseline+10%
Titanium	NV	NV	898	817	No	<Baseline+10%	827	No	<Baseline+10%
Uranium	23	NA	3	3	No	<SQG, <Baseline+10%	3	No	<SQG, <Baseline+10%
Vanadium	130 [f]	NA	28	25	No	<SQG, <Baseline+10%	25	No	<SQG, <Baseline+10%
Yttrium	NV	NV	NR	0.0028	No	NV	0.0299	No	NV
Zinc	10,000	NA	46	41	No	<SQG, <Baseline+10%	42	No	<SQG, <Baseline+10%

Note:

COPC = contaminant of potential concern; > = greater than; < = less than; mg/kg = milligram per kilogram; NA = not applicable; a soil guideline/standard is available from CCME or MOE, therefore screening against US EPA RSLs was not required; NR = not reported; a baseline value for this parameter was not available, therefore the predicted soil concentration is equal to the incremental soil concentration; NV = no value.

(a) Canadian Council of Ministers of the Environment (CCME). Canadian Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health. Residential land use. Parameter-specific Factsheets: Arsenic (1997); Barium (2013); Beryllium (2015); Cadmium (1999); Chromium: total chromium (1997); Copper (1999); Lead (1999); Nickel (2015); Selenium (2009); Thallium (1999); Uranium (2007); Vanadium (1997); Zinc (2018).

(c) United States Environmental Protection Agency (US EPA). 2015. Regional Screening Levels (RSL) for industrial soils. US EPA Region 9. Last updated November 2015. Accessed 08 April 2016 from http://www.epa.gov/region9/superfund/prg/.

RSLs were adjusted to reflect a hazard quotient of 0.2 (multiplied by 0.2).

(d) Maximum measured baseline soil concentration.

(e) Calculated as the sum of the baseline soil concentration and the incremental soil concentration from particulate deposition.

(f) Overall Residential/Parkland guideline (1991); CCME factsheet unavailable.

(g) Based on an incremental lifetime cancer risk of 1 in 1,000,000.

(h) Overall Residential/Parkland guideline (1999); only a SQG_E was derived (no value for SQG_{HH}).

Table 3: Soil Deposition Screening for Wildlife

Chemical	CCME SQG_E [a] (mg/kg)	US EPA EcoSSL [c] (mg/kg)	Baseline Soil Concentration [d] + 10% (mg/kg)	Approved Project			Expansion Project		
				Predicted Soil Concentration [e] (mg/kg)	Retained as a COPC?	Rationale	Predicted Soil Concentration [e] (mg/kg)	Retained as a COPC?	Rationale
Metals									
Aluminum	NV	Narrative [i]	10956	9980	No	<Baseline+10%	10179	No	<Baseline+10%
Antimony	20 [f]	NA	0.11	0.10	No	<SQG, <Baseline+10%	0.11	No	<SQG, <Baseline+10%
Arsenic	17	NA	14	13	No	<SQG, <Baseline+10%	13	No	<SQG, <Baseline+10%
Barium	500 [g]	NA	95	87	No	<SQG, <Baseline+10%	88	No	<SQG, <Baseline+10%
Beryllium	550 [h]	NA	0.6	0.5	No	<SQG, <Baseline+10%	0.5	No	<SQG, <Baseline+10%
Bismuth	NV	NV	NR	0.30	No	NV	0.30	No	NV
Cadmium	10	NA	0.07	0.06	No	<SQG, <Baseline+10%	0.06	No	<SQG, <Baseline+10%
Calcium	NV	NV	3982	3632	No	<Baseline+10%	3745	No	<Baseline+10%
Chromium	64	NA	154	140	No	>SQG, <Baseline+10%	141	No	>SQG, <Baseline+10%
Cobalt	50 [f]	NA	13	12	No	<SQG, <Baseline+10%	12	No	<SQG, <Baseline+10%
Copper	63	NA	11	10	No	<SQG, <Baseline+10%	10	No	<SQG, <Baseline+10%
Gold	NV	NV	NR	0.000023	No	NV	0.000245	No	NV
Iron	NV	NV	23650	21522	No	<Baseline+10%	21741	No	<Baseline+10%
Lead	300	NA	9	8	No	<SQG, <Baseline+10%	8	No	<SQG, <Baseline+10%
Lithium	NV	NV	13	12	No	<Baseline+10%	12	No	<Baseline+10%
Magnesium	NV	NV	9691	8816	No	<Baseline+10%	8876	No	<Baseline+10%
Manganese	NV	NV	495	450	No	<Baseline+10%	452	No	<Baseline+10%
Molybdenum	10 [f]	NA	0.56	0.51	No	<SQG, <Baseline+10%	0.51	No	<SQG, <Baseline+10%
Nickel	50	NA	69	63	No	>SQG, <Baseline+10%	63	No	>SQG, <Baseline+10%
Potassium	NV	NV	2079	1894	No	<Baseline+10%	1932	No	<Baseline+10%
Selenium	1	NA	0.22	0.20	No	<SQG, <Baseline+10%	0.20	No	<SQG, <Baseline+10%
Silver	20 [f]	NA	0.11	0.10	No	<SQG, <Baseline+10%	0.10	No	<SQG, <Baseline+10%
Sodium	NV	NV	124	118	No	<Baseline+10%	**163**	No (see text)	>Baseline+10%
Strontium	NV	NV	47	43	No	<Baseline+10%	43	No	<Baseline+10%
Thallium	1.4	NA	0.13	0.11	No	<SQG, <Baseline+10%	0.11	No	<SQG, <Baseline+10%
Tin	50 [f]	NA	2	2	No	<SQG, <Baseline+10%	2	No	<SQG, <Baseline+10%
Titanium	NV	NV	898	817	No	<Baseline+10%	827	No	<Baseline+10%
Uranium	500	NA	3	3	No	<SQG, <Baseline+10%	3	No	<SQG, <Baseline+10%
Vanadium	130	NA	28	25	No	<SQG, <Baseline+10%	25	No	<SQG, <Baseline+10%
Yttrium	NV	NV	NR	0.0028	No	NV	0.0299	No	NV
Zinc	250	NA	46	41	No	<SQG, <Baseline+10%	42	No	<SQG, <Baseline+10%

Note:

COPC = contaminant of potential concern; > = greater than; < = less than; mg/kg = milligram per kilogram; NA = not applicable; a soil guideline/standard is available from CCME or MOE, therefore screening against US EPA RSLs was not required; NR = not reported; a baseline value for this parameter was not available, therefore the predicted soil concentration is equal to the incremental soil concentration; NV = no value.

(c) United States Environmental Protection Agency (US EPA). 2015. Ecological Soil Screening Levels (EcoSSLs). Parameter-specific Reports: Aluminum (2003);

RSLs were adjusted to reflect a hazard quotient of 0.2 (multiplied by 0.2).

(d) Maximum measured baseline soil concentration.

(e) Calculated as the sum of the baseline soil concentration and the incremental soil concentration from particulate deposition.

(f) Overall Residential/Parkland guideline (1991); CCME factsheet unavailable.

(g) Overall Residential/Parkland guideline (1999); only a SQG_{HH} was derived (no value for SQG_E).

(h) Based on an incremental lifetime cancer risk of 1 in 1,000,000.

(i) An EcoSSL is only required for soils where pH is less than 5.5 (pH is >5.5 at the site).

ANNEX B-3

Water Quality

Table 1: Surface Water Quality Screening for Human Health - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of:			Baseline Levels + 10%				Predicted Maximum Total Concentrations				Retained as a COC?	Rationale
									Mammoth Lake Proper					
		Health Canada Drinking Water		US EPA RSL for Tapwater[(1)]	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters														
Total alkalinity, as CaCO3	mg/L	-	-	-	6.4	6.5	7.8	7.8	16[(B)]	21[(B)]	14[(B)]	7.4[(B)]	No	> B, NR
Total dissolved solids	mg/L	500	AO	-	24	20	22	22	57[(B)]	85[(B)]	56[(B)]	31[(B)]	No	> B, < G
Major Ions														
Calcium	mg/L	NR	-	-	2.6	2.8	2.2	2.2	6.6[(B)]	11[(B)]	7.7[(B)]	4.5[(B)]	No	> B, NR
Magnesium	mg/L	NR	-	-	0.87	0.95	0.94	0.94	2.0[(B)]	3.2[(B)]	2.3[(B)]	1.3[(B)]	No	> B, NR
Potassium	mg/L	-	-	-	0.58	0.63	0.37	0.65	3.7[(B)]	7.5[(B)]	5.6[(B)]	3.6[(B)]	No	> B, NR
Sodium	mg/L	200	AO	-	0.61	0.64	0.80	0.80	5.4[(B)]	6.1[(B)]	2.7[(B)]	0.94[(B)]	No	> B, < G
Fluoride	mg/L	1.5	MAC	-	0.036	0.028	0.042	0.042	0.11[(B)]	0.14[(B)]	0.094[(B)]	0.051[(B)]	No	> B, < G
Sulphate	mg/L	500	AO	-	3.2	3.6	1.3	2.6	14[(B)]	26[(B)]	19[(B)]	12[(B)]	No	> B, < G
Nutrients and Biological Indicators														
Dissolved phosphorus	mg-P/L	-	-	0.00008[(2)]	0.0042	0.0011	0.0011	0.0011	0.048[(B)]	0.058[(B)]	0.037[(B)]	0.0041	No	> B, NR
Dissolved Metals														
Antimony	µg/L	6	MAC	-	0.06	0.06	0.06	0.06	2.6[(B)]	3.0[(B)]	1.3[(B)]	0.64[(B)]	No	> B, < G
Arsenic	µg/L	10	MAC	-	0.52	0.35	0.17	0.18	**18[(D, B)]**	**20[(D, B)]**	8.5[(B)]	2.8[(B)]	**Yes**	**> B, > G**
Barium	µg/L	1000	MAC	-	5.2	6.7	3.4	8.1	12[(B)]	19[(B)]	12[(B)]	6.2[(B)]	No	>B, < G
Beryllium	µg/L	-	-	5	0.06	0.01	0.01	0.01	0.024	0.025	0.012	0.005	No	< B, <G
Bismuth	µg/L	-	-	-	0.28	0.03	0.03	0.03	0.033	0.033	0.024	0.011	No	< B, NG
Chromium	µg/L	50	MAC	-	0.06	0.06	0.06	0.06	0.94[(B)]	1.1[(B)]	0.25[(B)]	0.031	No	> B, < G
Cobalt	µg/L	-	-	1.2	0.06	0.06	0.06	0.06	0.56[(B)]	0.67[(B)]	0.32[(B)]	0.087[(B)]	No	> B, < G
Lithium	µg/L	-	-	8	0.55	0.55	0.55	0.55	1.7[(B)]	2.7[(B)]	1.9[(B)]	1.1[(B)]	No	> B, < G
Manganese	µg/L	50	AO	86[(3)]	3.5	0.65	0.75	0.75	**74[(D, B)]**	**121[(D, B)]**	50[(B)]	5.2[(B)]	**Yes**	**> B, > G**
Molybdenum	µg/L	-	-	20	0.028	0.028	0.028	0.028	1.4[(B)]	3.1[(B)]	2.3[(B)]	1.5[(B)]	No	> B, < G
Nickel	µg/L	-	-	78	0.98	0.72	0.28	0.28	5.1[(B)]	6.5[(B)]	3.0[(B)]	0.67	No	> B, < G
Strontium	µg/L	-	-	2400	14.3	12.1	6.8	9.0	43[(B)]	65[(B)]	45[(B)]	26[(B)]	No	> B, < G
Thallium	µg/L	-	-	0.04	0.006	0.006	0.006	0.006	0.023[(B)]	0.025[(B)]	0.015[(B)]	0.0076[(B)]	No	> B, < G
Tin	µg/L	-	-	2400	0.055	0.13	0.14	0.30	0.096[(B)]	0.15[(B)]	0.11[(B)]	0.062[(B)]	No	> B, < G
Vanadium	µg/L	-	-	17.2	0.55	0.28	0.28	0.28	2.8[(B)]	3.2[(B)]	1.1[(B)]	0.48	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[(B)] = concentration higher than the relevant baseline level or beyond the recommended pH or DO concentration range.

[(D)] = concentration higher than the relevant drinking water guideline or beyond the recommended pH or DO concentration range.

[(1)] = In the absence of Health Canada guidelines, US EPA RSLs for tapwater adjusted for a hazard quotient of 0.2 were used

[(2)] = Value for phosphorus (white) used

[(3)] = Value for non-diet manganese

- = no guideline or data.

AO - Aesthetic objective; COC - Contaminant of concern; DO - Dissolved oxygen; MAC - Maximum acceptable concentration; NR - Not relevant for human health; mg/L = milligrams per litre; mg-P/L = milligrams phosphorus per litre; NR = Not relevant for human health; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Summary Table. October 2014.

United States Environmental Protection Agency (US EPA), 2015. Regional Screening Levels (RSLs) - Generic Tables (November 2015). Online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015. Summary Table [tapwater, TR=1e-06, THQ=0.1)

Table 1: Surface Water Quality Screening for Human Health - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of:			Baseline Levels + 10%				Predicted Maximum Total Concentrations				Retained as a COC?	Rationale
									Lake A15					
		Health Canada Drinking Water		US EPA RSL for Tapwater[1]	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters														
Total alkalinity, as CaCO3	mg/L	-	-	-	6.4	6.5	7.8	7.8	15[B]	18[B]	14[B]	7.2[B]	No	> B, NR
Total dissolved solids	mg/L	500	AO	-	24	20	22	22	52[B]	70[B]	52[B]	30[B]	No	> B, < G
Major Ions														
Calcium	mg/L	NR	-	-	2.6	2.8	2.2	2.2	6.1[B]	8.8[B]	7.2[B]	4.2[B]	No	> B, NR
Magnesium	mg/L	NR	-	-	0.87	0.95	0.94	0.94	1.9[B]	2.6[B]	2.2[B]	1.3[B]	No	> B, NR
Potassium	mg/L	-	-	-	0.58	0.63	0.37	0.65	3.3[B]	6.0[B]	5.0[B]	3.3[B]	No	> B, NR
Sodium	mg/L	200	AO	-	0.61	0.64	0.80	0.80	4.9[B]	5.2[B]	2.7[B]	0.9[B]	No	> B, < G
Fluoride	mg/L	1.5	MAC	-	0.036	0.028	0.042	0.042	0.097[B]	0.12[B]	0.089[B]	0.049[B]	No	> B, < G
Sulphate	mg/L	500	AO	-	3.2	3.6	1.3	2.6	13[B]	21[B]	17[B]	11[B]	No	> B, < G
Nutrients and Biological Indicators														
Dissolved phosphorus	mg-P/L	-	-	0.00008[2]	0.0042	0.0011	0.0011	0.0011	0.043[B]	0.048[B]	0.034[B]	0.0041[B]	No	> B, NR
Dissolved Metals														
Antimony	µg/L	6	MAC	-	0.06	0.06	0.06	0.06	2.3[B]	2.5[B]	1.2[B]	0.59[B]	No	> B , < G
Arsenic	µg/L	10	MAC	-	0.52	0.35	0.17	0.18	**16[D, B]**	**17[D, B]**	8.3[B]	2.6[B]	**Yes**	**> B, > G**
Barium	µg/L	1000	MAC	-	5.2	6.7	3.4	8.1	11[B]	16[B]	12[B]	6.1	No	> B, < G
Beryllium	µg/L	-	-	5	0.06	0.01	0.01	0.01	0.022[B]	0.023[B]	0.013[B]	0.0054	No	> B, < G
Bismuth	µg/L	-	-	-	0.28	0.03	0.03	0.03	**0.032[B]**	**0.032[B]**	**0.026[B]**	0.012	**Yes**	**> B, NG**
Chromium	µg/L	50	MAC	-	0.06	0.06	0.06	0.06	0.83[B]	0.89[B]	0.26[B]	0.033	No	> B, < G
Cobalt	µg/L	-	-	1.2	0.06	0.06	0.06	0.06	0.5[B]	0.56[B]	0.33[B]	0.083[B]	No	> B, < G
Lithium	µg/L	-	-	8	0.55	0.55	0.55	0.55	1.5[B]	2.3[B]	1.8[B]	1.1[B]	No	> B, < G
Manganese	µg/L	50	AO	86[3]	3.5	0.65	0.75	0.75	**65[D, B]**	**96[D, B]**	**53[D, B]**	4.8[B]	**Yes**	**> B, > G**
Molybdenum	µg/L	-	-	20	0.028	0.028	0.028	0.028	1.3[B]	2.4[B]	2.0[B]	1.3[B]	No	> B, < G
Nickel	µg/L	-	-	78	0.98	0.72	0.28	0.28	4.6[B]	5.4[B]	3.1[B]	0.65	No	> B, < G
Strontium	µg/L	-	-	2400	14.3	12.1	6.8	9.0	39[B]	53[B]	42[B]	24[B]	No	> B, < G
Thallium	µg/L	-	-	0.04	0.006	0.006	0.006	0.006	0.02[B]	0.022[B]	0.014[B]	0.0073[B]	No	> B, < G
Tin	µg/L	-	-	2400	0.055	0.13	0.14	0.30	0.096	0.14[B]	0.11	0.064	No	> B, < G
Vanadium	µg/L	-	-	17.2	0.55	0.28	0.28	0.28	2.5[B]	2.7[B]	1.1[B]	0.46[B]	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[B] = concentration higher than the relevant baseline level or beyond the recommended pH or DO concentration range.

[D] = concentration higher than the relevant drinking water guideline or beyond the recommended pH or DO concentration range.

[1] = In the absence of Health Canada guidelines, US EPA RSLs for tapwater adjusted for a hazard quotient of 0.2 were used

[2] = Value for phosphorus (white) used

[3] = Value for non-diet manganese

- = no guideline or data.

AO - Aesthetic objective; COC - Contaminant of concern; DO - Dissolved oxygen; MAC - Maximum acceptable concentration; NR - Not relevant for human health; mg/L = milligrams per litre; mg-P/L = milligrams phosphorus per litre; NR = Not relevant for human health; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Summary Table. October 2014.

United States Environmental Protection Agency (US EPA), 2015. Regional Screening Levels (RSLs) - Generic Tables (November 2015). Online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015. Summary Table [tapwater, TR=1e-06, THQ=0.1)

Table 1: Surface Water Quality Screening for Human Health - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of:			Baseline Levels + 10%				Predicted Maximum Total Concentrations				Retained as a COC?	Rationale
									Lake A12					
		Health Canada Drinking Water		US EPA RSL for Tapwater[(1)]	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters														
Total alkalinity, as CaCO3	mg/L	-	-	-	6.4	6.5	7.8	7.8	14[(B)]	17[(B)]	13[(B)]	7.1[(B)]	No	> B, NR
Total dissolved solids	mg/L	500	AO	-	24	20	22	22	49[(B)]	64[(B)]	49[(B)]	28[(B)]	No	> B, < G
Major Ions														
Calcium	mg/L	NR	-	-	2.6	2.8	2.2	2.2	5.8[(B)]	8.0[(B)]	6.7[(B)]	4.1[(B)]	No	> B, NR
Magnesium	mg/L	NR	-	-	0.87	0.95	0.94	0.94	1.8[(B)]	2.4[(B)]	2.0[(B)]	1.2[(B)]	No	> B, NR
Potassium	mg/L	-	-	-	0.58	0.63	0.37	0.65	3.1[(B)]	5.3[(B)]	4.7[(B)]	3.1[(B)]	No	> B, NR
Sodium	mg/L	200	AO	-	0.61	0.64	0.80	0.80	4.6[(B)]	4.7[(B)]	2.6[(B)]	0.88[(B)]	No	> B, < G
Fluoride	mg/L	1.5	MAC	-	0.036	0.028	0.042	0.042	0.093[(B)]	0.11[(B)]	0.085[(B)]	0.047[(B)]	No	> B, < G
Sulphate	mg/L	500	AO	-	3.2	3.6	1.3	2.6	12[(B)]	19[(B)]	16[(B)]	10[(B)]	No	> B, < G
Nutrients and Biological Indicators														
Dissolved phosphorus	mg-P/L	-	-	0.00008[(2)]	0.0042	0.0011	0.0011	0.0011	0.04[(B)]	0.043[(B)]	0.032[(B)]	0.0041[(B)]	No	> B, NR
Dissolved Metals														
Antimony	µg/L	6	MAC	-	0.06	0.06	0.06	0.06	2.2[(B)]	2.2[(B)]	1.1[(B)]	0.54[(B)]	No	> B, < G
Arsenic	µg/L	10	MAC	-	0.52	0.35	0.17	0.18	**15[(D, B)]**	**15[(D, B)]**	8.1[(B)]	2.4[(B)]	**Yes**	**> B, > G**
Barium	µg/L	1000	MAC	-	5.2	6.7	3.4	8.1	11[(B)]	15[(B)]	12[(B)]	6.0	No	> B, < G
Beryllium	µg/L	-	-	5	0.06	0.01	0.01	0.01	0.022[(B)]	0.022[(B)]	0.014[(B)]	0.0059	No	> B, < G
Bismuth	µg/L	-	-	-	0.28	0.03	0.03	0.03	**0.032[(B)]**	**0.033[(B)]**	**0.027[(B)]**	0.013	**Yes**	**> B, NG**
Chromium	µg/L	50	MAC	-	0.06	0.06	0.06	0.06	0.78[(B)]	0.81[(B)]	0.27[(B)]	0.035	No	> B, < G
Cobalt	µg/L	-	-	1.2	0.06	0.06	0.06	0.06	0.47[(B)]	0.51[(B)]	0.33[(B)]	0.081[(B)]	No	> B, < G
Lithium	µg/L	-	-	8	0.55	0.55	0.55	0.55	1.5[(B)]	2.1[(B)]	1.7[(B)]	1.0[(B)]	No	> B, < G
Manganese	µg/L	50	AO	86[(3)]	3.5	0.65	0.75	0.75	**61[(B)]**	**85[(B)]**	**54[(B)]**	4.5[(B)]	**Yes**	**> B, > G**
Molybdenum	µg/L	-	-	20	0.028	0.028	0.028	0.028	1.2[(B)]	2.1[(B)]	1.9[(B)]	1.2[(B)]	No	> B, < G
Nickel	µg/L	-	-	78	0.98	0.72	0.28	0.28	4.3[(B)]	4.8[(B)]	3.2[(B)]	0.63	No	> B, < G
Strontium	µg/L	-	-	2400	14.3	12.1	6.8	9.0	38[(B)]	48[(B)]	40[(B)]	23[(B)]	No	> B, < G
Thallium	µg/L	-	-	0.04	0.006	0.006	0.006	0.006	0.02[(B)]	0.02[(B)]	0.014[(B)]	0.0071[(B)]	No	> B, < G
Tin	µg/L	-	-	2400	0.055	0.13	0.14	0.30	0.1	0.14[(B)]	0.11	0.069	No	> B, < G
Vanadium	µg/L	-	-	17.2	0.55	0.28	0.28	0.28	2.4[(B)]	2.4[(B)]	1.1[(B)]	0.44[(B)]	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[(B)] = concentration higher than the relevant baseline level or beyond the recommended pH or DO concentration range.

[(D)] = concentration higher than the relevant drinking water guideline or beyond the recommended pH or DO concentration range.

[(1)] = In the absence of Health Canada guidelines, US EPA RSLs for tapwater adjusted for a hazard quotient of 0.2 were used

[(2)] = Value for phosphorus (white) used

[(3)] = Value for non-diet manganese

- = no guideline or data.

AO - Aesthetic objective; COC - Contaminant of concern; DO - Dissolved oxygen; MAC - Maximum acceptable concentration; NR - Not relevant for human health; mg/L = milligrams per litre; mg-P/L = milligrams phosphorus per litre; NR = Not relevant for human health; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Summary Table. October 2014.

United States Environmental Protection Agency (US EPA), 2015. Regional Screening Levels (RSLs) - Generic Tables (November 2015). Online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015. Summary Table [tapwater, TR=1e-06, THQ=0.1)

Table 1: Surface Water Quality Screening for Human Health - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of:			Baseline Levels + 10%				Predicted Maximum Total Concentrations				Retained as a COC?	Rationale
		Health Canada Drinking Water		US EPA RSL for Tapwater[1]	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Downstream Node 1					
									Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters														
Total alkalinity, as CaCO3	mg/L	-	-	-	6.4	6.5	7.8	7.8	6.3	6.2	6.6	5.9	No	< B, NR
Total dissolved solids	mg/L	500	AO	-	24	20	22	22	16	15	17	15	No	< B, < G
Major Ions														
Calcium	mg/L	NR	-	-	2.6	2.8	2.2	2.2	2.3[B]	2.2	2.5[B]	2.2	No	> B, NR
Magnesium	mg/L	NR	-	-	0.87	0.95	0.94	0.94	0.74	0.72	0.8	0.72	No	< B, NR
Potassium	mg/L	-	-	-	0.58	0.63	0.37	0.65	0.68[B]	0.68[B]	0.88[B]	0.78[B]	No	> B, NR
Sodium	mg/L	200	AO	-	0.61	0.64	0.80	0.80	0.93[B]	0.89[B]	0.89[B]	0.69	No	> B, < G
Fluoride	mg/L	1.5	MAC	-	0.036	0.028	0.042	0.042	0.032	0.031	0.034	0.03	No	< B, < G
Sulphate	mg/L	500	AO	-	3.2	3.6	1.3	2.6	2.9[B]	2.8[B]	3.5[B]	3.1[B]	No	> B, < G
Nutrients and Biological Indicators														
Dissolved phosphorus	mg-P/L	-	-	0.00008[2]	0.0042	0.0011	0.0011	0.0011	0.0044[B]	0.004[B]	0.0047[B]	0.002[B]	No	> B, NR
Dissolved Metals														
Antimony	µg/L	6	MAC	-	0.06	0.06	0.06	0.06	0.2[B]	0.18[B]	0.17[B]	0.11[B]	No	> B, < G
Arsenic	µg/L	10	MAC	-	0.52	0.35	0.17	0.18	1.2[B]	1.1[B]	1.0[B]	0.41[B]	No	> B, < G
Barium	µg/L	1000	MAC	-	5.2	6.7	3.4	8.1	6.0[B]	6.0[B]	6.3[B]	5.7[B]	No	> B, < G
Beryllium	µg/L	-	-	5	0.06	0.01	0.01	0.01	0.011[B]	0.011[B]	0.011[B]	0.01	No	> B, < G
Bismuth	µg/L	-	-	-	0.28	0.03	0.03	0.03	0.026	0.026	0.026	0.025	No	< B, NG
Chromium	µg/L	50	MAC	-	0.06	0.06	0.06	0.06	0.1[B]	0.096[B]	0.079[B]	0.05	No	> B, < G
Cobalt	µg/L	-	-	1.2	0.06	0.06	0.06	0.06	0.08[B]	0.076[B]	0.082[B]	0.055[B]	No	> B, < G
Lithium	µg/L	-	-	8	0.55	0.55	0.55	0.55	0.58[B]	0.57[B]	0.64[B]	0.57[B]	No	> B, < G
Manganese	µg/L	50	AO	86[3]	3.5	0.65	0.75	0.75	4.9[B]	4.4[B]	6.3[B]	1.1[B]	No	> B, < G
Molybdenum	µg/L	-	-	20	0.028	0.028	0.028	0.028	0.11[B]	0.11[B]	0.2[B]	0.16[B]	No	> B, < G
Nickel	µg/L	-	-	78	0.98	0.72	0.28	0.28	0.68[B]	0.65[B]	0.71[B]	0.44[B]	No	> B, < G
Strontium	µg/L	-	-	2400	14.3	12.1	6.8	9.0	11[B]	10[B]	12[B]	10[B]	No	> B, < G
Thallium	µg/L	-	-	0.04	0.006	0.006	0.006	0.006	0.0062[B]	0.0060	0.0061[B]	0.0054[B]	No	> B, < G
Tin	µg/L	-	-	2400	0.055	0.13	0.14	0.30	0.11	0.12	0.12	0.11	No	< B, < G
Vanadium	µg/L	-	-	17.2	0.55	0.28	0.28	0.28	0.4[B]	0.38[B]	0.36[B]	0.28[B]	No	> B, < G

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Notes:

[B] = concentration higher than the relevant baseline level or beyond the recommended pH or DO concentration range.

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[1] = In the absence of Health Canada guidelines, US EPA RSLs for tapwater adjusted for a hazard quotient of 0.2 were used

[2] = Value for phosphorus (white) used

[3] = Value for non-diet manganese

- = no guideline or data.

AO - Aesthetic objective; COC - Contaminant of concern; DO - Dissolved oxygen; MAC - Maximum acceptable concentration; NR - Not relevant for human health; mg/L = milligrams per litre; mg-P/L = milligrams phosphorus per litre; NR = Not relevant for human health; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Summary Table. October 2014.

United States Environmental Protection Agency (US EPA), 2015. Regional Screening Levels (RSLs) - Generic Tables (November 2015). Online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015. Summary Table [tapwater, TR=1e-06, THQ=0.1)

Table 1: Surface Water Quality Screening for Human Health - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of:			Baseline Levels + 10%				Predicted Maximum Total Concentrations				Retained as a COC?	Rationale
									Downstream Node 2					
		Health Canada Drinking Water		US EPA RSL for Tapwater[1]	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters														
Total alkalinity, as CaCO3	mg/L	-	-	-	6.4	6.5	7.8	7.8	9.5[B]	9.5[B]	9.9[B]	6.8	No	> B, NR
Total dissolved solids	mg/L	500	AO	-	24	20	22	22	29[B]	30[B]	32[B]	22	No	> B, < G
Major Ions														
Calcium	mg/L	NR	-	-	2.6	2.8	2.2	2.2	3.7[B]	3.9[B]	4.5[B]	3.2[B]	No	> B, NR
Magnesium	mg/L	NR	-	-	0.87	0.95	0.94	0.94	1.2[B]	1.2[B]	1.4[B]	0.99[B]	No	> B, NR
Potassium	mg/L	-	-	-	0.58	0.63	0.37	0.65	1.6[B]	1.9[B]	2.5[B]	1.9[B]	No	> B, NR
Sodium	mg/L	200	AO	-	0.61	0.64	0.80	0.80	2.3[B]	2.2[B]	1.7[B]	0.82[B]	No	> B, < G
Fluoride	mg/L	1.5	MAC	-	0.036	0.028	0.042	0.042	0.056[B]	0.054[B]	0.058[B]	0.039	No	> B, < G
Sulphate	mg/L	500	AO	-	3.2	3.6	1.3	2.6	6.4[B]	7.2[B]	8.9[B]	6.4[B]	No	> B, < G
Nutrients and Biological Indicators														
Dissolved phosphorus	mg-P/L	-	-	0.00008[2]	0.0042	0.0011	0.0011	0.0011	0.018[B]	0.017[B]	0.016[B]	0.0034[B]	No	> B, NR
Dissolved Metals														
Antimony	µg/L	6	MAC	-	0.06	0.06	0.06	0.06	0.93[B]	0.89[B]	0.61[B]	0.31[B]	No	> B, < G
Arsenic	µg/L	10	MAC	-	0.52	0.35	0.17	0.18	6.3[B]	6.0[B]	4.3[B]	1.4[B]	No	> B, < G
Barium	µg/L	1000	MAC	-	5.2	6.7	3.4	8.1	8.1	8.7[B]	9.2[B]	6.2	No	> B, < G
Beryllium	µg/L	-	-	5	0.06	0.01	0.01	0.01	0.016[B]	0.015[B]	0.013[B]	0.0096	No	> B, < G
Bismuth	µg/L	-	-	-	0.28	0.03	0.03	0.03	0.03	0.03	0.029	0.023	No	< B, NG
Chromium	µg/L	50	MAC	-	0.06	0.06	0.06	0.06	0.36[B]	0.35[B]	0.19[B]	0.05	No	> B, < G
Cobalt	µg/L	-	-	1.2	0.06	0.06	0.06	0.06	0.23[B]	0.22[B]	0.2[B]	0.07[B]	No	> B, < G
Lithium	µg/L	-	-	8	0.55	0.55	0.55	0.55	0.95[B]	1.0[B]	1.1[B]	0.81[B]	No	> B, < G
Manganese	µg/L	50	AO	86[3]	3.5	0.65	0.75	0.75	26[B]	26[B]	28[B]	2.7[B]	No	> B, < G
Molybdenum	µg/L	-	-	20	0.028	0.028	0.028	0.028	0.51[B]	0.64[B]	0.87[B]	0.65[B]	No	> B, < G
Nickel	µg/L	-	-	78	0.98	0.72	0.28	0.28	2.1[B]	2.0[B]	1.9[B]	0.55[B]	No	> B, < G
Strontium	µg/L	-	-	2400	14.3	12.1	6.8	9.0	22[B]	21[B]	25[B]	17[B]	No	> B, < G
Thallium	µg/L	-	-	0.04	0.006	0.006	0.006	0.006	0.012[B]	0.011[B]	0.0099[B]	0.0065[B]	No	> B, < G
Tin	µg/L	-	-	2400	0.055	0.13	0.14	0.30	0.12	0.13	0.12	0.11	No	< B, < G
Vanadium	µg/L	-	-	17.2	0.55	0.28	0.28	0.28	1.2[B]	1.1[B]	0.72[B]	0.37[B]	No	> B, < G

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[1] = In the absence of Health Canada guidelines, US EPA RSLs for tapwater adjusted for a hazard quotient of 0.2 were used

[2] = Value for phosphorus (white) used

[3] = Value for non-diet manganese

- = no guideline or data.

AO - Aesthetic objective; COC - Contaminant of concern; DO - Dissolved oxygen; MAC - Maximum acceptable concentration; NR - Not relevant for human health; mg/L = milligrams per litre; mg-P/L = milligrams phosphorus per litre; NR = Not relevant for human health; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Summary Table. October 2014.

United States Environmental Protection Agency (US EPA), 2015. Regional Screening Levels (RSLs) - Generic Tables (November 2015). Online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015. Summary Table [tapwater, TR=1e-06, THQ=0.1)

Table 2: Surface Water Quality Screening for Human Health - On-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of:			Baseline Levels + 10%		Whale Tail Lake			Flooded Pit		
		Health Canada Drinking Water		US EPA RSL for Tapwater[1]	Whale Tail Lake	Flooded Pit	Predicted Maximum Total Concentrations Long Term	Retained as a COC?	Rationale	Predicted Maximum Total Concentrations Long Term	Retained as a COC?	Rationale
Conventional Parameters												
Total alkalinity, as CaCO3	mg/L	-	-	-	6.1	6.1	0.24	No	< B, NR	11[B]	No	> B, NR
Total dissolved solids	mg/L	500	AO	-	23	23	1.0	No	< B, < G	41[B]	No	> B, < G
Major Ions												
Calcium	mg/L	NR	-	-	2.4	2.4	0.43	No	< B, NR	5.6[B]	No	> B, NR
Magnesium	mg/L	NR	-	-	0.87	0.87	0.45	No	< B, NR	1.8[B]	No	> B, NR
Potassium	mg/L	-	-	-	0.48	0.48	0.27	No	< B, NR	3.6[B]	No	> B, NR
Sodium	mg/L	200	AO	-	0.61	0.61	0.039	No	< B, < G	2.1[B]	No	> B, < G
Sulphate	mg/L	500	AO	-	2.9	2.9	0.35	No	< B, < G	12[B]	No	> B, < G
Nutrients and Biological Indicators												
Total phosphorus	mg-P/L	-	-	0.00008[2]	0.0033	-	**0.011[D,B]**	**Yes**	**> B, > G**	-	No	No values
Dissolved phosphorus	mg-P/L	-	-	0.00008[2]	0.00308	0.00308	-	No	No values	0.021[B]	No	> B, NR
Metals[5]												
Aluminum	µg/L	100	OG	-	24	12	**322[D, B]**	**Yes**	**> B, > G**	0.2	No	< B, < G
Antimony	µg/L	6	MAC	-	0.24	0.06	0.044	No	< B, < G	0.74[B]	No	> B, < G
Arsenic	µg/L	10	MAC	-	0.32	0.33	5.7[B]	No	> B, < G	10[B]	No	> B, < G
Barium	µg/L	1000	MAC	-	4.8	4.6	3.3	No	< B, < G	10[B]	No	> B, < G
Chromium	µg/L	50	MAC	-	0.15	0.055	9.0[B]	No	> B, < G	0.15[B]	No	> B, < G
Cobalt	µg/L	-	-	1.2	0.055	0.055	0.53[B]	No	> B, < G	0.27[B]	No	> B, < G
Iron	µg/L	300	AO	2800	41	106	754[B]	No	> B, < G	30	No	< B, < G
Lithium	µg/L	-	-	8	0.55	0.55	0.32	No	< B, < G	1.5[B]	No	> B, < G
Manganese	µg/L	50	AO	86[3]	7.0	5.0	13[B]	No	> B, < G	**51[B]**	**Yes**	**> B, > G**
Molybdenum	µg/L	-	-	20	0.065	0.028	0.063	No	< B, < G	1.5[B]	No	> B, < G
Nickel	µg/L	-	-	78[4]	0.946	0.902	4.6[B]	No	> B, < G	2.6[B]	No	> B, < G
Strontium	µg/L	-	-	2400	17	17	2.1	No	< B, < G	34[B]	No	> B, < G
Thallium	µg/L	-	-	0.04	0.0055	0.0055	0.0054	No	< B, < G	0.011[B]	No	> B, < G
Tin	µg/L	-	-	2400	0.055	0.055	0.0079	No	< B, < G	0.094[B]	No	> B, < G
Vanadium	µg/L	-	-	17.2	0.55	0.55	0.83[B]	No	> B, < G	0.67[B]	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision*after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[B] = concentration higher than the relevant baseline level or beyond the recommended pH or DO concentration range.

[D] = concentration higher than the relevant drinking water guideline or beyond the recommended pH or DO concentration range.

[1] = In the absence of Health Canada guidelines, US EPA RSLs for tapwater adjusted for a hazard quotient of 0.2 were used

[2] = Value for phosphorus (white) used

[3] = Value for non-diet manganese

[4] = Value for soluble nickel salts

[5] = Predicted concentrations presented as total metals concentrations for Whale Tail lake, and dissolved metals concentrations for Flooded Pit

- = no guideline or data.

AO = Aesthetic objective; CaCO3 = calcium carbonate; COC = Contaminant of concern; DO = Dissolved oxygen; OG = Operational guideline; MAC = Maximum acceptable concentration; mg/L = milligrams per litre; mg-P/L = milligrams phosphorus per litre; NR = Not relevant for human health; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Health Canada, 2014. Guidelines for Canadian Drinking Water Quality Summary Table. October 2014.

United States Environmental Protection Agency (US EPA), 2015. Regional Screening Levels (RSLs) - Generic Tables (November 2015). Online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015. Summary Table [tapwater, TR=1e-06, THQ=0.1)

Table 3: Surface Water Quality Screening for Aquatic Life - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of: Aquatic Life Chronic (CCME)	Baseline Levels + 10% Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Predicted Maximum Dissolved Concentrations Mammoth Lake Proper Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term	Retained as a COC?	Rationale
Conventional Parameters												
Total alkalinity, as $CaCO_3$	mg/L	-	6.4	6.5	7.8	7.8	16[(B)]	21[(B)]	14[(B)]	7.4[(B)]	No	> B, NG[(8)]
Total dissolved solids	mg/L	-	24	20	22	22	**57[(B)]**	**85[(B)]**	**56[(B)]**	**31[(B)]**	**Yes**	**> B, NG**
Major Ions												
Calcium	mg/L	-	2.6	2.75	2.2	2.2	6.6[(B)]	11[(B)]	7.7[(B)]	4.5[(B)]	No	> B, NG[(8)]
Magnesium	mg/L	-	0.87	0.95	0.94	0.94	2.0[(B)]	3.2[(B)]	2.3[(B)]	1.3[(B)]	No	> B, NG[(8)]
Potassium	mg/L	-	0.58	0.63	0.37	0.65	3.7[(B)]	7.5[(B)]	5.6[(B)]	3.6[(B)]	No	> B, NG[(8)]
Sodium	mg/L	-	0.61	0.64	0.80	0.80	5.4[(B)]	6.1[(B)]	2.7[(B)]	0.94[(B)]	No	> B, NG[(8)]
Fluoride	mg/L	0.12	0.036	0.028	0.042	0.042	0.11[(B)]	**0.14[(B)]**	0.094[(B)]	0.051[(B)]	**Yes**	**> B, > G**
Sulphate	mg/L	128[(1)]	3.2	3.6	1.3	2.6	14[(B)]	26[(B)]	19[(B)]	12[(B)]	No	> B, < G
Nutrients and Biological Indicators												
Dissolved phosphorus	mg-P/L	-	0.0042	0.0011	0.0011	0.0011	0.048[(B)]	0.058[(B)]	0.037[(B)]	0.0041	No	> B, NG[(9)]
Dissolved Metals												
Antimony	µg/L	9[(2)]	0.06	0.06	0.06	0.06	2.6[(B)]	3.0[(B)]	1.3[(B)]	0.64[(B)]	No	> B, <G
Arsenic	µg/L	5	0.52	0.35	0.17	0.18	**18[(C, B)]**	**20[(C, B)]**	**8.5[(C, B)]**	2.8[(B)]	**Yes**	**> B, > G**
Barium	µg/L	1000[(2)]	5.2	6.7	3.4	8.1	12[(B)]	19[(B)]	12[(B)]	6.2[(B)]	No	> B, < G
Beryllium	µg/L	0.13[(2)]	0.06	0.01	0.01	0.01	0.024	0.025	0.012	0.005	No	< B, < G
Bismuth	µg/L	0.7[(3)]	0.28	0.028	0.028	0.028	0.033	0.033	0.024	0.011	No	< B, < G
Chromium	µg/L	1[(4)]	0.06	0.06	0.06	0.06	0.94[(B)]	**1.1[(C, B)]**	0.25[(B)]	0.031	**Yes**	**> B, > G**
Cobalt	µg/L	2.5[(5)]	0.06	0.06	0.06	0.06	0.56[(B)]	0.67[(B)]	0.32[(B)]	0.087[(B)]	No	> B, < G
Lithium	µg/L	-	0.55	0.55	0.55	0.55	**1.7[(B)]**	**2.7[(B)]**	**1.9[(B)]**	**1.1[(B)]**	**Yes**	**> B, NG**
Manganese	µg/L	1700[(3)]	3.5	0.65	0.75	0.75	74[(B)]	121[(B)]	50[(B)]	5.2[(B)]	No	> B, < G
Molybdenum	µg/L	73	0.028	0.028	0.028	0.028	1.4[(B)]	3.1[(B)]	2.3[(B)]	1.5[(B)]	No	> B, < G
Nickel	µg/L	25[(7)]	0.98	0.72	0.28	0.28	5.1[(B)]	6.5[(B)]	3.0[(B)]	0.67	No	> B, < G
Strontium	µg/L	-	14	12	6.8	9.0	**43[(B)]**	**65[(B)]**	**45[(B)]**	**26[(B)]**	**Yes**	**> B, NG**
Thallium	µg/L	0.8	0.006	0.006	0.006	0.006	0.023[(B)]	0.025[(B)]	0.015[(B)]	0.0076[(B)]	No	> B, < G
Tin	µg/L	3[(3)]	0.055	0.13	0.14	0.30	0.096[(B)]	0.15[(B)]	0.11[(B)]	0.062[(B)]	No	> B, < G
Vanadium	µg/L	120[(6)]	0.55	0.28	0.28	0.28	2.8[(B)]	3.2[(B)]	1.1[(B)]	0.48	No	< B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[(B)] = concentration higher than the relevant baseline level.

[(C)] = concentration higher than the relevant chronic aquatic life guideline.

[(1)] = In the absence of CCME guidelines, the BC MOE water quality guideline was used (based on observed hardness of 16.94 mg/L and observed pH of >6.5, if applicable).

[(2)] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.

[(3)] = In the absence of CCME guidelines for bismuth, manganese and tin, the ANZECC 2000 guidelines were used.

[(4)] = CCME value for hexavalent chromium used in the absence of value for chromium.

[(5)] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).

[(6)] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).

[(7)] = CCME value based on available observed hardness value of 16.94 mg/L.

[(8)] Alkalinity, calcium, potassium, magnesium and sodium were not identified as COCs because they are a component of TDS, a parameter which was identified as a COC and included in the assessment.

[(9)] Phosphorus is a nutrient that can exert adverse effects at high concentrations via eutrophication. This parameter was not retained as a COC because potential effects related to eutrophication are assessed separately in the FEIS.

- = no guideline or data.

$CaCO_3$ = calcium carbonate; COC = Contaminant of concern; mg/L = milligrams per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosporus per litre; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Australia and New Zealand Environment and Conservation Council (ANZECC), 2000. Australian and New Zealand guidelines for fresh and marine water quality, 2000. Volume 2 - Aquatic ecosystems - rationale and background information. National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation. 678p. Accessed on-line at http://www.environment.gov.au/resource/australian-and-new-zealand-guidelines-fresh-and-marine-water-quality-volume-2-aquatic.

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Environment Canada, 2013. Federal Environmental Quality Guidelines. Cobalt. Canadian Environmental Protection Act, 1999. February 2013.

Table 3: Surface Water Quality Screening for Aquatic Life - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of: Aquatic Life	Baseline Levels + 10%				Predicted Maximum Dissolved Concentrations				Retained as a COC?	Rationale
							Lake A15					
		Chronic (CCME)	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters												
Total alkalinity, as $CaCO_3$	mg/L	-	6.4	6.5	7.8	7.8	15[(B)]	18[(B)]	14[(B)]	7.2[(B)]	No	> B, NG[(8)]
Total dissolved solids	mg/L	-	24	20	22	22	**52[(B)]**	**70[(B)]**	**52[(B)]**	**30[(B)]**	**Yes**	**> B, NG**
Major Ions												
Calcium	mg/L	-	2.6	2.75	2.2	2.2	6.1[(B)]	8.8[(B)]	7.2[(B)]	4.2[(B)]	No	> B, NG[(8)]
Magnesium	mg/L	-	0.87	0.95	0.94	0.94	1.9[(B)]	2.6[(B)]	2.2[(B)]	1.3[(B)]	No	> B, NG[(8)]
Potassium	mg/L	-	0.58	0.63	0.37	0.65	3.3[(B)]	6.0[(B)]	5.0[(B)]	3.3[(B)]	No	> B, NG[(8)]
Sodium	mg/L	-	0.61	0.64	0.80	0.80	4.9[(B)]	5.2[(B)]	2.7[(B)]	0.9[(B)]	No	> B, NG[(8)]
Fluoride	mg/L	0.12	0.036	0.028	0.042	0.042	0.097[(B)]	0.12[(B)]	0.089[(B)]	0.049[(B)]	No	> B, < G
Sulphate	mg/L	128[(1)]	3.2	3.6	1.3	2.6	13[(B)]	21[(B)]	17[(B)]	11[(B)]	No	> B, < G
Nutrients and Biological Indicators												
Dissolved phosphorus	mg-P/L	-	0.0042	0.0011	0.0011	0.0011	0.043[(B)]	0.048[(B)]	0.034[(B)]	0.0041[(B)]	No	> B, NG[(9)]
Dissolved Metals												
Antimony	µg/L	9[(2)]	0.06	0.06	0.06	0.06	2.3[(B)]	2.5[(B)]	1.2[(B)]	0.59[(B)]	No	> B, < G
Arsenic	µg/L	5	0.52	0.35	0.17	0.18	**16[(C, B)]**	**17[(C, B)]**	**8.3[(C, B)]**	2.6[(B)]	**Yes**	**> B, > G**
Barium	µg/L	1000[(2)]	5.2	6.7	3.4	8.1	11[(B)]	16[(B)]	12[(B)]	6.1	No	> B, < G
Beryllium	µg/L	0.13[(2)]	0.06	0.01	0.01	0.01	0.022[(B)]	0.023[(B)]	0.013[(B)]	0.0054	No	> B, < G
Bismuth	µg/L	0.7[(3)]	0.28	0.028	0.028	0.028	0.032[(B)]	0.032[(B)]	0.026	0.012	No	> B, < G
Chromium	µg/L	1[(4)]	0.06	0.06	0.06	0.06	0.83[(B)]	0.89[(B)]	0.26[(B)]	0.033	No	> B, < G
Cobalt	µg/L	2.5[(5)]	0.06	0.06	0.06	0.06	0.5[(B)]	0.56[(B)]	0.33[(B)]	0.083[(B)]	No	> B, < G
Lithium	µg/L	-	0.55	0.55	0.55	0.55	**1.5[(B)]**	**2.3[(B)]**	**1.8[(B)]**	**1.1[(B)]**	**Yes**	**> B, NG**
Manganese	µg/L	1700[(3)]	3.5	0.65	0.75	0.75	65[(B)]	96[(B)]	53[(B)]	4.8[(B)]	No	> B, < G
Molybdenum	µg/L	73	0.028	0.028	0.028	0.028	1.3[(B)]	2.4[(B)]	2.0[(B)]	1.3[(B)]	No	> B, < G
Nickel	µg/L	25[(7)]	0.98	0.72	0.28	0.28	4.6[(B)]	5.4[(B)]	3.1[(B)]	0.65	No	> B, < G
Strontium	µg/L	-	14	12	6.8	9.0	**39[(B)]**	**53[(B)]**	**42[(B)]**	**24[(B)]**	**Yes**	**> B, NG**
Thallium	µg/L	0.8	0.006	0.006	0.006	0.006	0.02[(B)]	0.022[(B)]	0.014[(B)]	0.0073[(B)]	No	> B, < G
Tin	µg/L	3[(3)]	0.055	0.13	0.14	0.30	0.096	0.14[(B)]	0.11	0.064	No	> B, < G
Vanadium	µg/L	120[(6)]	0.55	0.28	0.28	0.28	2.5[(B)]	2.7[(B)]	1.1[(B)]	0.46[(B)]	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[(B)] = concentration higher than the relevant baseline level.

[(C)] = concentration higher than the relevant chronic aquatic life guideline.

[(1)] = In the absence of CCME guidelines, the BC MOE water quality guideline was used (based on observed hardness of 16.94 mg/L and observed pH of >6.5, if applicable).

[(2)] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.

[(3)] = In the absence of CCME guidelines for bismuth, manganese and tin, the ANZECC 2000 guidelines were used.

[(4)] = CCME value for hexavalent chromium used in the absence of value for chromium.

[(5)] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).

[(6)] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).

[(7)] = CCME value based on available observed hardness value of 16.94 mg/L.

[(8)] Alkalinity, calcium, potassium, magnesium and sodium were not identified as COCs because they are a component of TDS, a parameter which was iden

[(9)] Phosphorus is a nutrient that can exert adverse effects at high concentrations via eutrophication. This parameter was not retained as a COC because p

- = no guideline or data.

$CaCO_3$ = calcium carbonate; COC = Contaminant of concern; mg/L = milligrams per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosporus per litre; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Australia and New Zealand Environment and Conservation Council (ANZECC), 2000. Australian and New Zealand guidelines for fresh and marine water quality, 2000. Volume 2 - Aquatic ecosystems - rationale and background information. National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation. 678p. Accessed on-line at http://www.environment.gov.au/resource/australian-and-new-zealand-guidelines-fresh-and-marine-water-quality-volume-2-aquatic.

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Table 3: Surface Water Quality Screening for Aquatic Life - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of: Aquatic Life	Baseline Levels + 10%				Predicted Maximum Dissolved Concentrations				Retained as a COC?	Rationale
							Lake A12					
		Chronic (CCME)	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters												
Total alkalinity, as $CaCO_3$	mg/L	-	6.4	6.5	7.8	7.8	14[(B)]	17[(B)]	13[(B)]	7.1[(B)]	No	> B, NG[(8)]
Total dissolved solids	mg/L	-	24	20	22	22	**49[(B)]**	**64[(B)]**	**49[(B)]**	**28[(B)]**	**Yes**	**> B, NG**
Major Ions												
Calcium	mg/L	-	2.6	2.75	2.2	2.2	5.8[(B)]	8.0[(B)]	6.7[(B)]	4.1[(B)]	No	> B, NG[(8)]
Magnesium	mg/L	-	0.87	0.95	0.94	0.94	1.8[(B)]	2.4[(B)]	2.0[(B)]	1.2[(B)]	No	> B, NG[(8)]
Potassium	mg/L	-	0.58	0.63	0.37	0.65	3.1[(B)]	5.3[(B)]	4.7[(B)]	3.1[(B)]	No	> B, NG[(8)]
Sodium	mg/L	-	0.61	0.64	0.80	0.80	4.6[(B)]	4.7[(B)]	2.6[(B)]	0.88[(B)]	No	> B, NG[(8)]
Fluoride	mg/L	0.12	0.036	0.028	0.042	0.042	0.093[(B)]	0.11[(B)]	0.085[(B)]	0.047[(B)]	No	> B, < G
Sulphate	mg/L	128[(1)]	3.2	3.6	1.3	2.6	12[(B)]	19[(B)]	16[(B)]	10[(B)]	No	> B, < G
Nutrients and Biological Indicators												
Dissolved phosphorus	mg-P/L	-	0.0042	0.0011	0.0011	0.0011	0.04[(B)]	0.043[(B)]	0.032[(B)]	0.0041[(B)]	No	> B, NG[(9)]
Dissolved Metals												
Antimony	µg/L	9[(2)]	0.06	0.06	0.06	0.06	2.2[(B)]	2.2[(B)]	1.1[(B)]	0.54[(B)]	No	> B, <G
Arsenic	µg/L	5	0.52	0.35	0.17	0.18	**15[(C, B)]**	**15[(C, B)]**	**8.1[(C, B)]**	2.4[(B)]	**Yes**	**> B, > G**
Barium	µg/L	1000[(2)]	5.2	6.7	3.4	8.1	11[(B)]	15[(B)]	12[(B)]	6.0	No	> B, < G
Beryllium	µg/L	0.13[(2)]	0.06	0.01	0.01	0.01	0.022[(B)]	0.022[(B)]	0.014[(B)]	0.0059	No	> B, < G
Bismuth	µg/L	0.7[(3)]	0.28	0.028	0.028	0.028	0.032[(B)]	0.033[(B)]	0.027	0.013	No	> B, < G
Chromium	µg/L	1[(4)]	0.06	0.06	0.06	0.06	0.78[(B)]	0.81[(B)]	0.27[(B)]	0.035	No	> B, < G
Cobalt	µg/L	2.5[(5)]	0.06	0.06	0.06	0.06	0.47[(B)]	0.51[(B)]	0.33[(B)]	0.081[(B)]	No	> B, < G
Lithium	µg/L	-	0.55	0.55	0.55	0.55	**1.5[(B)]**	**2.1[(B)]**	**1.7[(B)]**	**1.0[(B)]**	**Yes**	**> B, NG**
Manganese	µg/L	1700[(3)]	3.5	0.65	0.75	0.75	61[(B)]	85[(B)]	54[(B)]	4.5[(B)]	No	> B, < G
Molybdenum	µg/L	73	0.028	0.028	0.028	0.028	1.2[(B)]	2.1[(B)]	1.9[(B)]	1.2[(B)]	No	> B, < G
Nickel	µg/L	25[(7)]	0.98	0.72	0.28	0.28	4.3[(B)]	4.8[(B)]	3.2[(B)]	0.63	No	> B, < G
Strontium	µg/L	-	14	12	6.8	9.0	**38[(B)]**	**48[(B)]**	**40[(B)]**	**23[(B)]**	**Yes**	**> B, NG**
Thallium	µg/L	0.8	0.006	0.006	0.006	0.006	0.02[(B)]	0.02[(B)]	0.014[(B)]	0.0071[(B)]	No	> B, < G
Tin	µg/L	3[(3)]	0.055	0.13	0.14	0.30	0.1	0.14[(B)]	0.11	0.069	No	> B, < G
Vanadium	µg/L	120[(6)]	0.55	0.28	0.28	0.28	2.4[(B)]	2.4[(B)]	1.1[(B)]	0.44[(B)]	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[(B)] = concentration higher than the relevant baseline level.

[(C)] = concentration higher than the relevant chronic aquatic life guideline.

[(1)] = In the absence of CCME guidelines, the BC MOE water quality guideline was used (based on observed hardness of 16.94 mg/L and observed pH of >6.5, if applicable).

[(2)] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.

[(3)] = In the absence of CCME guidelines for bismuth, manganese and tin, the ANZECC 2000 guidelines were used.

[(4)] = CCME value for hexavalent chromium used in the absence of value for chromium.

[(5)] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).

[(6)] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).

[(7)] = CCME value based on available observed hardness value of 16.94 mg/L.

[(8)] Alkalinity, calcium, potassium, magnesium and sodium were not identified as COCs because they are a component of TDS, a parameter which was iden

[(9)] Phosphorus is a nutrient that can exert adverse effects at high concentrations via eutrophication. This parameter was not retained as a COC because p

- = no guideline or data.

$CaCO_3$ = calcium carbonate; COC = Contaminant of concern; mg/L = milligrams per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosporus per litre; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Australia and New Zealand Environment and Conservation Council (ANZECC), 2000. Australian and New Zealand guidelines for fresh and marine water quality, 2000. Volume 2 - Aquatic ecosystems - rationale and background information. National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation. 678p. Accessed on-line at http://www.environment.gov.au/resource/australian-and-new-zealand-guidelines-fresh-and-marine-water-quality-volume-2-aquatic.

British Columbia Ministry of the Environment (BC MOE), 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture. Summary Report. March 2016. Online: http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/waterqualityguidesobjs/approved-wat-qual-guides/final_approved_wqg_summary_march_2016.pdf.

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Table 3: Surface Water Quality Screening for Aquatic Life - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of: Aquatic Life	Baseline Levels + 10%				Predicted Maximum Dissolved Concentrations				Retained as a COC?	Rationale
							Downstream Node 1					
		Chronic (CCME)	Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term		
Conventional Parameters												
Total alkalinity, as $CaCO_3$	mg/L	-	6.4	6.5	7.8	7.8	6.3	6.2	6.6	5.9	No	< B, NG
Total dissolved solids	mg/L	-	24	20	22	22	16	15	17	15	No	< B, NG
Major Ions												
Calcium	mg/L	-	2.6	2.75	2.2	2.2	2.3[(B)]	2.2[(B)]	2.5[(B)]	2.2[(B)]	No	> B, NG[(8)]
Magnesium	mg/L	-	0.87	0.95	0.94	0.94	0.74	0.72	0.8	0.72	No	< B, NG
Potassium	mg/L	-	0.58	0.63	0.37	0.65	0.68[(B)]	0.68[(B)]	0.88[(B)]	0.78[(B)]	No	> B, NG[(8)]
Sodium	mg/L	-	0.61	0.64	0.80	0.80	0.93[(B)]	0.89[(B)]	0.89[(B)]	0.69	No	> B, NG[(8)]
Fluoride	mg/L	0.12	0.036	0.028	0.042	0.042	0.032	0.031	0.034	0.03	No	< B, < G
Sulphate	mg/L	128[(1)]	3.2	3.6	1.3	2.6	2.9[(B)]	2.8[(B)]	3.5[(B)]	3.1[(B)]	No	> B, < G
Nutrients and Biological Indicators												
Dissolved phosphorus	mg-P/L	-	0.0042	0.0011	0.0011	0.0011	0.0044[(B)]	0.004[(B)]	0.0047[(B)]	0.002[(B)]	No	> B, NG[(9)]
Dissolved Metals												
Antimony	µg/L	9[(2)]	0.06	0.06	0.06	0.06	0.2[(B)]	0.18[(B)]	0.17[(B)]	0.11[(B)]	No	> B, <G
Arsenic	µg/L	5	0.52	0.35	0.17	0.18	1.2[(B)]	1.1[(B)]	1.0[(B)]	0.41[(B)]	No	> B, < G
Barium	µg/L	1000[(2)]	5.2	6.7	3.4	8.1	6.0[(B)]	6.0[(B)]	6.3[(B)]	5.7[(B)]	No	> B, < G
Beryllium	µg/L	0.13[(2)]	0.06	0.01	0.01	0.01	0.011[(B)]	0.011[(B)]	0.011[(B)]	0.01	No	> B, < G
Bismuth	µg/L	0.7[(3)]	0.28	0.028	0.028	0.028	0.026	0.026	0.026	0.025	No	< B, < G
Chromium	µg/L	1[(4)]	0.06	0.06	0.06	0.06	0.1[(B)]	0.096[(B)]	0.079[(B)]	0.05	No	> B, < G
Cobalt	µg/L	2.5[(5)]	0.06	0.06	0.06	0.06	0.08[(B)]	0.076[(B)]	0.082[(B)]	0.055	No	> B, < G
Lithium	µg/L	-	0.55	0.55	0.55	0.55	**0.58[(B)]**	**0.57[(B)]**	**0.64[(B)]**	**0.57[(B)]**	**Yes**	**> B, NG**
Manganese	µg/L	1700[(3)]	3.5	0.65	0.75	0.75	4.9[(B)]	4.4[(B)]	6.3[(B)]	1.1[(B)]	No	> B, < G
Molybdenum	µg/L	73	0.028	0.028	0.028	0.028	0.11[(B)]	0.11[(B)]	0.2[(B)]	0.16[(B)]	No	> B, < G
Nickel	µg/L	25[(7)]	0.98	0.72	0.28	0.28	0.68[(B)]	0.65[(B)]	0.71[(B)]	0.44[(B)]	No	> B, < G
Strontium	µg/L	-	14	12	6.8	9.0	**11[(B)]**	**10[(B)]**	**12[(B)]**	**10[(B)]**	**Yes**	**> B, NG**
Thallium	µg/L	0.8	0.006	0.006	0.006	0.006	0.0062[(B)]	0.006	0.0061[(B)]	0.0054	No	> B, < G
Tin	µg/L	3[(3)]	0.055	0.13	0.14	0.30	0.11	0.12	0.12	0.11	No	< B, < G
Vanadium	µg/L	120[(6)]	0.55	0.28	0.28	0.28	0.4[(B)]	0.38[(B)]	0.36[(B)]	0.28	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[(B)] = concentration higher than the relevant baseline level.

[(C)] = concentration higher than the relevant chronic aquatic life guideline.

[(1)] = In the absence of CCME guidelines, the BC MOE water quality guideline was used (based on observed hardness of 16.94 mg/L and observed pH of >6.5, if applicable).

[(2)] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.

[(3)] = In the absence of CCME guidelines for bismuth, manganese and tin, the ANZECC 2000 guidelines were used.

[(4)] = CCME value for hexavalent chromium used in the absence of value for chromium.

[(5)] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).

[(6)] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).

[(7)] = CCME value based on available observed hardness value of 16.94 mg/L.

[(8)] Alkalinity, calcium, potassium, magnesium and sodium were not identified as COCs because they are a component of TDS, a parameter which was iden

[(9)] Phosphorus is a nutrient that can exert adverse effects at high concentrations via eutrophication. This parameter was not retained as a COC because p

- = no guideline or data.

$CaCO_3$ = calcium carbonate; COC = Contaminant of concern; mg/L = milligrams per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosporus per litre; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Australia and New Zealand Environment and Conservation Council (ANZECC), 2000. Australian and New Zealand guidelines for fresh and marine water quality, 2000. Volume 2 - Aquatic ecosystems - rationale and background information. National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation. 678p. Accessed on-line at http://www.environment.gov.au/resource/australian-and-new-zealand-guidelines-fresh-and-marine-water-quality-volume-2-aquatic.

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Environment Canada, 2013. Federal Environmental Quality Guidelines. Cobalt. Canadian Environmental Protection Act, 1999. February 2013.

Table 3: Surface Water Quality Screening for Aquatic Life - Off-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of: Aquatic Life Chronic (CCME)	Baseline Levels + 10% Mammoth Lake	A15 and A12	Downstream Node 1	Downstream Node 2	Predicted Maximum Dissolved Concentrations Downstream Node 2 Operational	Closure (January 2022 to June 2029, inclusive)	Post-Closure Year 1	Long Term	Retained as a COC?	Rationale
Conventional Parameters												
Total alkalinity, as $CaCO_3$	mg/L	-	6.4	6.5	7.8	7.8	9.5(B)	9.5(B)	9.9(B)	6.8	No	> B, NG(8)
Total dissolved solids	mg/L	-	24	20	22	22	**29(B)**	**30(B)**	**32(B)**	22	**Yes**	**> B, NG**
Major Ions												
Calcium	mg/L	-	2.6	2.75	2.2	2.2	3.7(B)	3.9(B)	4.5(B)	3.2(B)	No	> B, NG(8)
Magnesium	mg/L	-	0.87	0.95	0.94	0.94	1.2(B)	1.2(B)	1.4(B)	0.99(B)	No	> B, NG(8)
Potassium	mg/L	-	0.58	0.63	0.37	0.65	1.6(B)	1.9(B)	2.5(B)	1.9(B)	No	> B, NG(8)
Sodium	mg/L	-	0.61	0.64	0.80	0.80	2.3(B)	2.2(B)	1.7(B)	0.82(B)	No	> B, NG(8)
Fluoride	mg/L	0.12	0.036	0.028	0.042	0.042	0.056(B)	0.054(B)	0.058(B)	0.039	No	> B, < G
Sulphate	mg/L	128(1)	3.2	3.6	1.3	2.6	6.4(B)	7.2(B)	8.9(B)	6.4(B)	No	> B, < G
Nutrients and Biological Indicators												
Dissolved phosphorus	mg-P/L	-	0.0042	0.0011	0.0011	0.0011	0.018(B)	0.017(B)	0.016(B)	0.0034(B)	No	> B, NG(8)
Dissolved Metals												
Antimony	µg/L	9(2)	0.06	0.06	0.06	0.06	0.93(B)	0.89(B)	0.61(B)	0.31(B)	No	> B, <G
Arsenic	µg/L	5	0.52	0.35	0.17	0.18	**6.3(C, B)**	**6.0(C, B)**	4.3(B)	1.4(B)	**Yes**	**> B, > G**
Barium	µg/L	1000(2)	5.2	6.7	3.4	8.1	8.1	8.7(B)	9.2(B)	6.2	No	> B, < G
Beryllium	µg/L	0.13(2)	0.06	0.01	0.01	0.01	0.016(B)	0.015(B)	0.013(B)	0.0096	No	> B, < G
Bismuth	µg/L	0.7(3)	0.28	0.028	0.028	0.028	0.03(B)	0.03(B)	0.029(B)	0.023	No	> B, < G
Chromium	µg/L	1(4)	0.06	0.06	0.06	0.06	0.36(B)	0.35(B)	0.19(B)	0.05	No	> B, < G
Cobalt	µg/L	2.5(5)	0.06	0.06	0.06	0.06	0.23(B)	0.22(B)	0.2(B)	0.07(B)	No	> B, < G
Lithium	µg/L	-	0.55	0.55	0.55	0.55	**0.95(B)**	**1.0(B)**	**1.1(B)**	**0.81(B)**	**Yes**	**> B, NG**
Manganese	µg/L	1700(3)	3.5	0.65	0.75	0.75	26(B)	26(B)	28(B)	2.7(B)	No	> B, < G
Molybdenum	µg/L	73	0.028	0.028	0.028	0.028	0.51(B)	0.64(B)	0.87(B)	0.65(B)	No	> B, < G
Nickel	µg/L	25(7)	0.98	0.72	0.28	0.28	2.1(B)	2.0(B)	1.9(B)	0.55(B)	No	> B, < G
Strontium	µg/L	-	14	12	6.8	9.0	**22(B)**	**21(B)**	**25(B)**	**17(B)**	**Yes**	**> B, NG**
Thallium	µg/L	0.8	0.006	0.006	0.006	0.006	0.012(B)	0.011(B)	0.0099(B)	0.0065(B)	No	> B, < G
Tin	µg/L	3(3)	0.055	0.13	0.14	0.30	0.12	0.13	0.12	0.11	No	< B, < G
Vanadium	µg/L	120(6)	0.55	0.28	0.28	0.28	1.2(B)	1.1(B)	0.72(B)	0.37(B)	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

(B) = concentration higher than the relevant baseline level.

(C) = concentration higher than the relevant chronic aquatic life guideline.

(1) = In the absence of CCME guidelines, the BC MOE water quality guideline was used (based on observed hardness of 16.94 mg/L and observed pH of >6.5, if applicable).

(2) = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.

(3) = In the absence of CCME guidelines for bismuth, manganese and tin, the ANZECC 2000 guidelines were used.

(4) = CCME value for hexavalent chromium used in the absence of value for chromium.

(5) = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).

(6) = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).

(7) = CCME value based on available observed hardness value of 16.94 mg/L.

(8) Alkalinity, calcium, potassium, magnesium and sodium were not identified as COCs because they are a component of TDS, a parameter which was iden

(9) Phosphorus is a nutrient that can exert adverse effects at high concentrations via eutrophication. This parameter was not retained as a COC because p

- = no guideline or data.

$CaCO_3$ = calcium carbonate; COC = Contaminant of concern; mg/L = milligrams per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosporus per litre; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

Australia and New Zealand Environment and Conservation Council (ANZECC), 2000. Australian and New Zealand guidelines for fresh and marine water quality, 2000. Volume 2 - Aquatic ecosystems - rationale and background information. National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation. 678p. Accessed on-line at http://www.environment.gov.au/resource/australian-and-new-zealand-guidelines-fresh-and-marine-water-quality-volume-2-aquatic.

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Canadian Council of Ministers of the Environment (CCME), current to April 2016. Canadian Water Quality Guidelines for the Protection of Aquatic Life.

Environment Canada/Health Canada (EC/HC), 2010. Screening Assessment for the Challenge, Vanadium oxide (Vanadium pentoxide). Chemical Abstracts Service Registry Number 1314-62-1. September 2010.

Environment Canada, 2013. Federal Environmental Quality Guidelines. Cobalt. Canadian Environmental Protection Act, 1999. February 2013.

Table 4: Surface Water Quality Screening for Aquatic Life - On-Site Waterbodies (Approved Project)

Parameter	Unit	Guidelines for the protection of:	Baseline Levels + 10%		Whale Tail Lake			Flooded Pit		
		Aquatic Life	Whale Tail Lake	Flooded Pit	Predicted Maximum Total Concentrations	Retained as a COC?	Rationale	Predicted Maximum Dissolved Concentrations	Retained as a COC?	Rationale
		Chronic (CCME)			Long Term			Long Term		
Conventional Parameters										
Total alkalinity, as $CaCO_3$	mg/L	-	6.1	6.1	0.24	No	< B, NG	11[B]	No	> B, NG[9]
Total dissolved solids	mg/L	-	23	23	1.0	No	< B, NG	**41[B]**	**Yes**	**> B, NG**
Major Ions										
Calcium	mg/L	-	2.4	2.4	0.43	No	< B, NG	5.6[B]	No	> B, NG[9]
Magnesium	mg/L	-	0.87	0.87	0.45	No	< B, NG	1.8[B]	No	> B, NG[9]
Potassium	mg/L	-	0.48	0.48	0.27	No	< B, NG	3.6[B]	No	> B, NG[9]
Sodium	mg/L	-	0.61	0.61	0.039	No	< B, NG	2.1[B]	No	> B, NG[9]
Sulphate	mg/L	128[1]	2.9	2.9	0.35	No	< B, < G	12[B]	No	> B, < G
Nutrients and Biological Indicators										
Total phosphorus	mg-N/L	-	0.0033	-	0.011[B]	No	> B, NG[10]	-	No	No values
Dissolved phosphorus	mg-P/L	-	0.0031	0.0031	-	No	No values	0.021[B]	No	> B, NG[10]
Metals[8]										
Aluminum	µg/L	100[1]	24	12	**322[C, B]**	**Yes**	**> B, > G**	0.2	No	< B, < G
Antimony	µg/L	9[2]	0.24	0.06	0.044	No	< B, < G	0.74[B]	No	> B, < G
Arsenic	µg/L	5	0.32	0.33	**5.7[C, B]**	**Yes**	**> B, > G**	**10[C, B]**	**Yes**	**> B, > G**
Barium	µg/L	1000[2]	4.8	4.6	3.3	No	< B, < G	10[B]	No	> B, < G
Chromium	µg/L	1[3]	0.15	0.055	**9.0[C, B]**	**Yes**	**> B, > G**	0.15[B]	No	> B, < G
Cobalt	µg/L	2.5[4]	0.055	0.055	0.53[B]	No	> B, < G	0.27[B]	No	> B, < G
Iron	µg/L	300	41	106	**754[C, B]**	**Yes**	**> B, > G**	30	No	< B, < G
Lithium	µg/L	-	0.55	0.55	0.32	No	< B, NG	**1.5[B]**	**Yes**	**> B, NG**
Manganese	µg/L	1700[6]	7.0	5.0	13[B]	No	> B, < G	51[B]	No	> B, < G
Molybdenum	µg/L	73	0.065	0.028	0.063	No	< B, < G	1.5[B]	No	> B, < G
Nickel	µg/L	25[5]	0.95	0.90	4.6[B]	No	> B, < G	2.6[B]	No	> B, < G
Strontium	µg/L	-	17	17	2.1	No	< B, NG	**34[B]**	**Yes**	**> B, NG**
Thallium	µg/L	0.8	0.006	0.006	0.0054	No	< B, < G	0.011[B]	No	> B, < G
Tin	µg/L	3[6]	0.055	0.055	0.0079	No	< B, < G	0.094[B]	No	> B, < G
Vanadium	µg/L	120[7]	0.55	0.55	0.83[B]	No	> B, < G	0.67[B]	No	> B, < G

Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

Notes:

[B] = concentration higher than the relevant baseline level.

[C] = concentration higher than the relevant chronic aquatic life guideline.

[1] = In the absence of CCME guidelines, the BC MOE water quality guideline was used (based on observed hardness of 16.94 mg/L and observed pH of >6.5).

[2] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.

[3] = CCME value for hexavalent chromium used in the absence of value for chromium.

[4] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).

[5] = CCME value based on observed hardness value of 16.94 mg/L .

[6] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.

[7] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).

[8] = Predicted concentrations presented as total metals concentrations for Whale Tail Lake, and dissolved metals concentrations for Flooded Pit.

[9] Alkalinity, calcium, potassium, magnesium and sodium were not identified as COCs because they are a component of TDS, a parameter which was identified as a COC and included in the assessment.

[10] Phosphorus is a nutrient that can exert adverse effects at high concentrations via eutrophication. This parameter was not retained as a COC because potential effects related to eutrophication are assessed separately in the FEIS.

- = no guideline or data.

COC = Contaminant of concern; FEIS = Final Environmental Impact Statement; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosphorus per litre; mg/L = milligrams per litre; TDS = total dissolved solids; µg/L = micrograms per litre.

Screening:

Bold and shaded - Concentrations exceed baseline level+10% (B) and water quality guideline (G). If the water quality guideline is lower than the baseline+10%, the baseline+10% is used as the screening value. If there is no water quality guideline (NG), and a baseline value is available, baseline+10% is used as the screening value.

References:

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Table 5: Whale Tail Pit - Post-Closure (Expansion Project

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (Whale Tail)	Whale Tail Pit (Early Post-closure)	Whale Tail Pit (Late Post-closure)
		Aquatic Life	Human Health						
		CCME Chronic Guideline	Health Canada		U.S. EPA RSL			Maximum Concentration	Maximum Concentration
Conventional Parameters									
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	16	14
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	30	25
Major Ions									
Calcium	mg/L	-	NR	-	-	-	1.5	4.5[B]	3.9[B]
Chloride	mg/L	120	250	AO	-	-	0.85	5.8[B]	4.8[B]
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.024	0.072[B]	0.062[B]
Magnesium	mg/L	-	NR	-	-	-	0.59	1.3[B]	1.1[B]
Potassium	mg/L	-	-	-	-	-	0.35	1.6[B]	1.4[B]
Sodium	mg/L	-	200	AO	-	-	0.48	2.6[B]	2.0[B]
Sulphate	mg/L	128[a,f]	500	AO	-	-	1.2	6.0[B]	4.8[B]
Nutrients									
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.0025	0.44[B]	0.30[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.0025	**0.058**[C, B]	**0.041**[C, B]
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0010	**0.014**[C, B]	0.010[B]
Dissolved Metals									
Aluminum	µg/L	100[c]	100	AO	4000	-	2.7	0.20	0.20
Antimony	µg/L	9[d]	6	MAC	-	-	0.050	0.62[B]	0.49[B]
Arsenic	µg/L	5	10	MAC	-	25[e]	0.13	**30**[C, D, S, B]	**22**[C, D, B]
Barium	µg/L	1000[d]	1000	MAC	-	-	3.0	11[B]	9.2[B]
Beryllium	µg/L	0.13[d]	-	-	5	-	0.010	0.025[B]	0.024[B]
Bismuth	µg/L	0.7[f]	-	-	-	-	0.025	0.055[B]	0.054[B]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	39[B]	30[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.0025	0.012[B]	0.010[B]
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.050	0.36[B]	0.28[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.050	0.56[B]	0.42[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	0.31	1.1[B]	0.94[B]
Iron	µg/L	300	300	AO	2800	-	5.0	59[B]	46[B]
Lead	µg/L	1.0[g]	10	MAC	-	-	0.025	0.21[B]	0.16[B]
Lithium	µg/L	-	-	-	8	-	0.25	1.8[B]	1.6[B]
Manganese	µg/L	1700[g]	50	AO	86	-	0.37	**109**[D, B]	**74**[D, B]
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0025	0.010[B]	0.0091[B]
Molybdenum	µg/L	73	-	-	20	-	0.025	0.96[B]	0.77[B]
Nickel	µg/L	25[g]	-	-	78	-	0.25	5.4[B]	3.9[B]
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.20[B]	0.16[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.015[B]	0.014[B]
Strontium	µg/L	-	-	-	2400	-	7.5	28[B]	24[B]
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.014[B]	0.014[B]
Tin	µg/L	3[f]	-	-	2400	-	0.050	0.16[B]	0.15[B]
Uranium	µg/L	15	20	MAC	-	-	0.023	0.45[B]	0.37[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.25	0.91[B]	0.83[B]
Zinc	µg/L	7[k]	5000	AO	1200	-	0.50	2.4[B]	2.2[B]

[a] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[b] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of °C (receiving environment) and pH of 8.5 and water temperature of 15.0°C (effluent)
[c] = Guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[d] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.
[e] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
[f] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.
[g] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[h] = Guidline is for hexavalent chromium.
[i] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).
[j] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).
[k] = Guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.

[C] = concentration is higher than the chronic aquatic life CCME guideline or outside the recommended pH, DO or total alkalinity range.
[D] = concentration is higher than the drinking water Health Canada guideline.
[S] = concentration is higher than the Site-specific Water Quality Objective (SSWQO) developed for the Whale Tail Project (Volume 6, Appendix 6-N) guideline.
[B] = Concentration higher than the relevant baseline level, or beyond the reccomended pH or DO concentration range.
Bolded values represent constituents of potential concern (COPC
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi*after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceeda
- = no guideline or no data

References:

Australia and New Zealand Environment and Conservation Council (ANZECC), 2000. Australian and New Zealand guidelines for fresh and marine water quality, 2000. Volume 2 - Aquatic ecosystems - rationale and background information. National Water Quality Management Strategy,
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Health Canada, 2017. Guidelines for Canadian Drinking Water Quality. Summary Table. February 201
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Table 6: IVR Pit Post-Closure (Expansion Project

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (Whale Tail)	IVR Pit (Early Post-closure)	IVR Pit (Late Post-closure)
		Aquatic Life	Human Health						
		CCME Chronic Guideline	Health Canada		U.S. EPA RSL			Maximum Concentration	Maximum Concentration
Conventional Parameters									
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	10	10
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	15	15
Major Ions									
Calcium	mg/L	-	NR	-	-	-	1.5	2.7[B]	2.7[B]
Chloride	mg/L	120	250	AO	-	-	0.85	3.0[B]	2.9[B]
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.024	0.044[B]	0.045[B]
Magnesium	mg/L	-	NR	-	-	-	0.59	0.86[B]	0.86[B]
Potassium	mg/L	-	-	-	-	-	0.35	0.94[B]	0.94[B]
Sodium	mg/L	-	200	AO	-	-	0.48	0.68[B]	0.68[B]
Sulphate	mg/L	128[a,f]	500	AO	-	-	1.2	2.6[B]	2.5[B]
Nutrients									
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.0025	0.040[B]	0.037[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.0025	0.011[B]	0.010[B]
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0010	0.0032[B]	0.0032[B]
Dissolved Metals									
Aluminum	µg/L	100[c]	100	AO	4000	-	2.7	0.20	0.20
Antimony	µg/L	9[d]	6	MAC	-	-	0.050	0.28[B]	0.28[B]
Arsenic	µg/L	5	10	MAC	-	25[e]	0.13	**13**[C, D, B]	**12**[C, D, B]
Barium	µg/L	1000[d]	1000	MAC	-	-	3.0	5.4[B]	5.4[B]
Beryllium	µg/L	0.13[d]	-	-	5	-	0.010	0.022[B]	0.022[B]
Bismuth	µg/L	0.7[d]	-	-	-	-	0.025	0.053[B]	0.052[B]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	12[B]	12[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.0025	0.0061[B]	0.0060[B]
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.050	0.13[B]	0.14[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.050	0.15[B]	0.15[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	0.31	0.59[B]	0.60[B]
Iron	µg/L	300	300	AO	2800	-	5.0	24[B]	27[B]
Lead	µg/L	1.0[g]	10	MAC	-	-	0.025	0.068[B]	0.070[B]
Lithium	µg/L	-	-	-	8	-	0.25	1.2[B]	1.2[B]
Manganese	µg/L	1700[g]	50	AO	86	-	0.37	4.5[B]	4.5[B]
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0025	0.0076[B]	0.0077[B]
Molybdenum	µg/L	73	-	-	20	-	0.025	0.45[B]	0.46[B]
Nickel	µg/L	25[g]	-	-	78	-	0.25	0.89[B]	0.90[B]
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.088[B]	0.087[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.011[B]	0.011[B]
Strontium	µg/L	-	-	-	2400	-	7.5	17[B]	17[B]
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.012[B]	0.012[B]
Tin	µg/L	3[i]	-	-	2400	-	0.050	0.13[B]	0.13[B]
Uranium	µg/L	15	20	MAC	-	-	0.023	0.23[B]	0.23[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.25	0.70[B]	0.70[B]
Zinc	µg/L	7[k]	5000	AO	1200	-	0.50	1.7[B]	1.7[B]

[a] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[b] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of °C (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
[c] = Guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[d] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.
[e] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
[f] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.
[g] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[h] = Guidline is for hexavalent chromium.
[i] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).
[j] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).
[k] = Guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.

[C] = concentration is higher than the chronic aquatic life guideline or outside the recommended pH, DO or total alkalinity range.
[D] = concentration is higher than the human health-based guideline.
[S] = concentration is higher than the Site-specific Water Quality Objective (SSWQO) developed for the Whale Tail Project (Volume 6, Appendix 6-N) guideline.
[B] = Concentration higher than the relevant baseline level, or beyond the reccomended pH or DO concentration range.
Bolded values represent constituents of potential concern (COPC
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi*after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceeda
- = no guideline or no data

References:

Australia and New Zealand Environment and Conservation Council (ANZECC), 2000. Australian and New Zealand guidelines for fresh and marine water quality, 2000. Volume 2 - Aquatic ecosystems -
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Health Canada, 2017. Guidelines for Canadian Drinking Water Quality. Summary Table. February 201
United States Environmental Protection Agency, 2018. Regional Screening Levels Summary Table. May 2018. Online: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tab

Table 7: Whale Tail South - Operations, Closure, and Post-Closure (Expansion Projec

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (Whale Tail)	Whale Tail South (Operations)	Whale Tail South (Closure)	Whale Tail South (Early Post-closure)	Whale Tail South (Late Post-closure)
		Aquatic Life	Human Health								
		CCME Chronic Guideline	Health Canada		U.S. EPA RSL			Maximum Concentration	Maximum Concentration	Maximum Concentration	Maximum Concentration
Conventional Parameters											
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	27	27	9.0	9.0
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	59	59	12	12
Major Ions											
Calcium	mg/L	-	NR	-	-	-	1.5	7.8[(B)]	7.8[(B)]	2.3[(B)]	2.3[(B)]
Chloride	mg/L	120	250	AO	-	-	0.85	12[(B)]	12[(B)]	2.9[(B)]	2.9[(B)]
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.024	0.072[(B)]	0.072[(B)]	0.029[(B)]	0.029[(B)]
Magnesium	mg/L	-	NR	-	-	-	0.59	1.8[(B)]	1.8[(B)]	0.79[(B)]	0.79[(B)]
Potassium	mg/L	-	-	-	-	-	0.35	2.2[(B)]	2.2[(B)]	0.44[(B)]	0.44[(B)]
Sodium	mg/L	-	200	AO	-	-	0.48	4.9[(B)]	4.9[(B)]	0.60[(B)]	0.60[(B)]
Sulphate	mg/L	128[(a,f)]	500	AO	-	-	1.2	9.0[(B)]	8.9[(B)]	1.5[(B)]	1.5[(B)]
Nutrients											
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.0025	2.8[(B)]	2.8[(B)]	0.0057[(B)]	0.0056[(B)]
Total ammonia	mg-N/L	0.019[(b)]	NR	-	-	-	0.0025	**0.33[(C, B)]**	**0.34[(C, B)]**	0.0067[(B)]	0.0067[(B)]
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0010	**0.020[(C, B)]**	**0.020[(C, B)]**	0.0023[(B)]	0.0023[(B)]
Dissolved Metals											
Aluminum	µg/L	100[(c)]	100	AO	4000	-	2.7	5.6[(B)]	5.8[(B)]	5.8[(B)]	5.8[(B)]
Antimony	µg/L	9[(d)]	6	MAC	-	-	0.050	1.0[(B)]	1.0[(B)]	0.11[(B)]	0.11[(B)]
Arsenic	µg/L	5	10	MAC	-	25[(e)]	0.13	**26[(C, D, S, B)]**	**26[(C, D, S, B)]**	0.16[(B)]	0.16[(B)]
Barium	µg/L	1000[(d)]	1000	MAC	-	-	3.0	14[(B)]	14[(B)]	4.5[(B)]	4.5[(B)]
Beryllium	µg/L	0.13[(g)]	-	-	5	-	0.010	0.031[(B)]	0.031[(B)]	0.022[(B)]	0.022[(B)]
Bismuth	µg/L	0.7[(f)]	-	-	-	-	0.025	0.068[(B)]	0.069[(B)]	0.055[(B)]	0.055[(B)]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	77[(B)]	77[(B)]	11[(B)]	11[(B)]
Cadmium	µg/L	0.18 - 0.90[(g)]	5.0	MAC	-	-	0.0025	0.015[(B)]	0.015[(B)]	0.0055[(B)]	0.0055[(B)]
Chromium	µg/L	1.0[(h)]	50[(g)]	MAC	-	-	0.050	0.73[(R, B)]	0.73[(R, B)]	0.11[(B)]	0.11[(B)]
Cobalt	µg/L	2.5[(i)]	-	-	1.2	-	0.050	0.74[(B)]	0.74[(B)]	0.11[(B)]	0.11[(B)]
Copper	µg/L	2.0[(g)]	1000	MAC	-	-	0.31	1.6[(R, B)]	1.6[(R, B)]	0.53[(B)]	0.53[(B)]
Iron	µg/L	300	300	AO	2800	-	5.0	50[(B)]	50[(B)]	17[(B)]	17[(B)]
Lead	µg/L	1.0[(g)]	10	MAC	-	-	0.025	0.32[(B)]	0.32[(B)]	0.060[(B)]	0.060[(B)]
Lithium	µg/L	-	-	-	8	-	0.25	2.4[(B)]	2.4[(B)]	1.1[(B)]	1.1[(B)]
Manganese	µg/L	1700[(g)]	50	AO	86	-	0.37	**131[(D, B)]**	**131[(D, B)]**	1.7[(B)]	1.7[(B)]
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0025	0.011[(B)]	0.011[(B)]	0.0055[(B)]	0.0055[(B)]
Molybdenum	µg/L	73	-	-	20	-	0.025	0.93[(B)]	0.92[(B)]	0.055[(B)]	0.055[(B)]
Nickel	µg/L	25[(g)]	-	-	78	-	0.25	8.7[(B)]	8.7[(B)]	0.69[(B)]	0.69[(B)]
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.40[(B)]	0.40[(B)]	0.055[(B)]	0.055[(B)]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.025[(B)]	0.025[(B)]	0.011[(B)]	0.011[(B)]
Strontium	µg/L	-	-	-	2400	-	7.5	48[(R, B)]	48[(R, B)]	16[(B)]	16[(B)]
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.019[(B)]	0.019[(B)]	0.011[(B)]	0.011[(B)]
Tin	µg/L	3[(f)]	-	-	2400	-	0.050	0.16[(B)]	0.16[(B)]	0.11[(B)]	0.11[(B)]
Uranium	µg/L	15	20	MAC	-	-	0.023	0.37[(B)]	0.37[(B)]	0.034[(B)]	0.034[(B)]
Vanadium	µg/L	120[(j)]	-	-	17	-	0.25	1.2[(B)]	1.2[(B)]	0.55[(B)]	0.55[(B)]
Zinc	µg/L	7[(k)]	5000	AO	1200	-	0.50	3.2[(B)]	3.2[(B)]	1.2[(B)]	1.2[(B)]

[(a)] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[(b)] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of °C (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
[(c)] = Guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[(d)] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.
[(e)] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
[(f)] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.
[(g)] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[(h)] = Guidline is for hexavalent chromium.
[(i)] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).
[(j)] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).
[(k)] = Guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.

[(C)] = concentration is higher than the chronic aquatic life guideline or outside the recommended pH, DO or total alkalinity range.
[(D)] = concentration is higher than the human health-based guideline.
[(S)] = concentration is higher than the Site-specific Water Quality Objective (SSWQO) developed for the Whale Tail Project (Volume 6, Appendix 6-N) guideline.
[(B)] = Concentration higher than the relevant baseline level, or beyond the reccomended pH or DO concentration range.
Bolded values represent constituents of potential concern (COPC
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi*after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceeda
- = no guideline or no data

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Table 8: Mammoth Lake - Operations, Closure, and Post-Closure (Expansion Project)

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (Mammoth Lake)	Mammoth Lake (Operations)	Mammoth Lake (Closure)	Mammoth Lake (Early Post-closure)	Mammoth Lake (Late Post-closure)
		Aquatic Life	Human Health								
		CCME Chronic	Health Canada		U.S. EPA RSL			Maximum Concentration	Maximum Concentration	Maximum Concentration	Maximum Concentration
Conventional Parameters											
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	110	23	16	15
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	152	45	29	26
Major Ions											
Calcium	mg/L	-	NR	-	-	-	5.6	39[B]	6.7[B]	4.5	4.2
Chloride	mg/L	120	250	AO	-	-	9.2	74[B]	11[B]	5.7	5.1
Fluoride	mg/L	0.12	1.5	MAC	-	-	-	0.089	0.058	0.071	0.066
Magnesium	mg/L	-	NR	-	-	-	1.6	3.0[B]	1.6[B]	1.2	1.2
Potassium	mg/L	-	-	-	-	-	0.90	1.9[B]	1.5[B]	1.6[B]	1.5[B]
Sodium	mg/L	-	200	AO	-	-	0.87	7.3[B]	3.5[B]	2.3[B]	1.9[B]
Sulphate	mg/L	128-309[a,f]	500	AO	-	-	3.5	9.7[B]	6.4[B]	5.8[B]	5.1[B]
Nutrients											
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.0058	1.8[B]	1.8[R, B]	0.37[B]	0.28[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.028	**0.19[C, B]**	**0.18[C, B]**	**0.049[C, B]**	**0.039[C, B]**
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0022	**0.029[C, B]**	**0.015[C, R, T, B]**	**0.012[C, B]**	0.0099[B]
Dissolved Metals											
Aluminum	µg/L	100[c]	100	AO	4000	-	6.5	4.9	4.9	0.99	0.80
Antimony	µg/L	9[d]	6	MAC	-	-	0.050	0.71[B]	0.68[B]	0.57[B]	0.51[B]
Arsenic	µg/L	5	10	MAC	-	25[e]	0.43	**19[C, D, B]**	**17[C, D, B]**	**25[C, D, B]**	**21[C, D, B]**
Barium	µg/L	1000[d]	1000	MAC	-	-	11	19[B]	12[B]	11	9.6
Beryllium	µg/L	0.13[d]	-	-	5	-	0.050	0.033	0.028	0.025	0.024
Bismuth	µg/L	0.7[f]	-	-	-	-	0.25	0.063	0.063	0.055	0.054
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	103[B]	54[B]	34[B]	29[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.0050	0.019[B]	0.012[B]	0.011[B]	0.010[B]
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.050	0.95[B]	0.52[B]	0.31[B]	0.27[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.050	0.78[B]	0.51[B]	0.49[B]	0.41[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	0.53	1.8[B]	1.2[R, B]	1.0[B]	0.92[B]
Iron	µg/L	300	300	AO	2800	-	12	82[B]	41[B]	50[B]	44[B]
Lead	µg/L	1.0[g]	10	MAC	-	-	0.21	0.40[B]	0.23[B]	0.18	0.16
Lithium	µg/L	-	-	-	8	-	1.4	2.8[B]	2.0[B]	1.7[B]	1.6[B]
Manganese	µg/L	1700[g]	50	AO	86	-	2.6	**132[D, B]**	**85[D, B]**	**89[D, B]**	**70[D, B]**
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0054	0.0099[B]	0.0090[B]	0.010[B]	0.010[B]
Molybdenum	µg/L	73	-	-	20	-	0.025	2.1[B]	0.69[B]	0.97[B]	0.89[B]
Nickel	µg/L	25[g]	-	-	78	-	1.2	7.6[B]	5.6[B]	4.6[B]	3.7[B]
Selenium	µg/L	1.0	50	MAC	-	-	0.050	0.35[B]	0.26[B]	0.18[B]	0.16[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.022[B]	0.020[B]	0.015[B]	0.014[B]
Strontium	µg/L	-	-	-	2400	-	40	66[B]	38	27	25
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.016[B]	0.016[B]	0.014[B]	0.014[B]
Tin	µg/L	3[f]	-	-	2400	-	0.050	0.14[B]	0.14[B]	0.16[B]	0.16[B]
Uranium	µg/L	15	20	MAC	-	-	0.028	0.69[B]	0.27[B]	0.45[B]	0.42[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.50	0.92[B]	0.92[B]	0.91[B]	0.87[B]
Zinc	µg/L	7[K]	5000	AO	1200	-	0.50	3.1[B]	2.4[B]	2.4[B]	2.3[B]

[a] = the guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of 10ºC (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
[b] = guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[c] = guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (10 to 110 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[d] = guideline is hardness and dissolved organic carbon dependent. The guideline value shown is based on hardness of 17 mg/L and dissolved organic carbon of 1.7 mg/L. Guideline for each prediction was determined using predicted hardness and minimum dissolved organic carbon from the measured baseline.
[e] = guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.
[f] = guideline is for chromium VI.

[a] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[b] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of 10ºC (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
[c] = Guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[d] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.
[e] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
[f] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.
[g] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[h] = Guidline is for hexavalent chromium.
[i] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).
[j] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).
[k] = Guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.

[C] = concentration is higher than the chronic aquatic life guideline or outside the recommended pH, DO or total alkalinity range.
[D] = concentration is higher than the human health-based guideline.
[S] = concentration is higher than the Site-specific Water Quality Objective (SSWQO) developed for the Whale Tail Project (Volume 6, Appendix 6-N) guideline.
[B] = Concentration higher than the relevant baseline level, or beyond the reccomended pH or DO concentration range.
Bolded values represent constituents of potential concern (COPC
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisic *after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceedan
- = no guideline or no data.

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Table 9: Lake A15 - Operations, Closure, and Post-Closure (Expansion Project

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (A15/A12)	A15 (Operations)	A15 (Closure)	A15 (Early Post-closure)	A15 (Late Post-closure)
		Aquatic Life	Human Health								
		CCME Chronic Guideline	Health Canada		U.S. EPA RSL			Maximum Concentration	Maximum Concentration	Maximum Concentration	Maximum Concentration
Conventional Parameters											
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	86	21	16	14
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	120	39	27	24
Major Ions											
Calcium	mg/L	-	NR	-	-	-	2.5	30[B]	6.0[B]	4.3[B]	3.9[B]
Chloride	mg/L	120	250	AO	-	-	2.1	57[B]	9.3[B]	5.3[B]	4.8[B]
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.025	0.074[B]	0.052[B]	0.064[B]	0.060[B]
Magnesium	mg/L	-	NR	-	-	-	0.89	2.5[B]	1.4[B]	1.2[B]	1.1[B]
Potassium	mg/L	-	-	-	-	-	0.58	1.5[B]	1.3[B]	1.5[B]	1.4[B]
Sodium	mg/L	-	200	AO	-	-	0.67	5.8[B]	2.9[B]	2.0[B]	1.7[B]
Sulphate	mg/L	128-309[a,f]	500	AO	-	-	3.3	7.8[B]	5.5[B]	5.2[B]	4.7[B]
Nutrients											
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.014	1.4[B]	1.4[B]	0.32[B]	0.24[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.0071	**0.14[C, B]**	**0.14[C, B]**	**0.043[C, B]**	**0.034[C, B]**
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0010	**0.023[C, B]**	**0.013[C, B]**	0.010[B]	0.0087[B]
Dissolved Metals											
Aluminum	µg/L	100[c]	100	AO	4000	-	3.2	4.7[B]	4.6[B]	1.4	1.3
Antimony	µg/L	9[d]	6	MAC	-	-	0.050	0.56[B]	0.56[B]	0.50[B]	0.45[B]
Arsenic	µg/L	5	10	MAC	-	25[e]	0.32	**14[C, D, B]**	**13[C, D, B]**	**21[C, D, B]**	**18[C, D, B]**
Barium	µg/L	1000[d]	1000	MAC	-	-	6.1	16[B]	10[B]	10[B]	9.0[B]
Beryllium	µg/L	0.13[d]	-	-	5	-	0.010	0.030[B]	0.027[B]	0.024[B]	0.024[B]
Bismuth	µg/L	0.7[f]	-	-	-	-	0.025	0.061[B]	0.061[B]	0.055[B]	0.054[B]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	81[B]	45[B]	30[B]	26[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.0025	0.016[B]	0.011[B]	0.010[B]	0.0093[B]
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.050	0.73[B]	0.44[B]	0.28[B]	0.24[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.050	0.61[B]	0.43[B]	0.43[B]	0.37[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	0.79	1.4[B]	1.1[B]	0.94[B]	0.85[B]
Iron	µg/L	300	300	AO	2800	-	5.0	66[B]	36[B]	44[B]	39[B]
Lead	µg/L	1.0[g]	10	MAC	-	-	0.025	0.32[B]	0.20[B]	0.17[B]	0.14[B]
Lithium	µg/L	-	-	-	8	-	0.50	2.4[B]	1.8[B]	1.6[B]	1.5[B]
Manganese	µg/L	1700[g]	50	AO	86	-	0.58	**101[D, B]**	**67[D, B]**	**76[D, B]**	**60[D, B]**
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0025	0.0087[B]	0.0082[B]	0.0095[B]	0.0092[B]
Molybdenum	µg/L	73	-	-	20	-	0.025	1.6[B]	0.57[B]	0.81[B]	0.75[B]
Nickel	µg/L	25[g]	-	-	78	-	0.65	5.9[B]	4.5[B]	4.0[B]	3.3[B]
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.27[B]	0.21[B]	0.16[B]	0.14[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.019[B]	0.018[B]	0.014[B]	0.013[B]
Strontium	µg/L	-	-	-	2400	-	11	56[B]	33[B]	26[B]	24[B]
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.015[B]	0.015[B]	0.014[B]	0.013[B]
Tin	µg/L	3[f]	-	-	2400	-	0.12	0.14[B]	0.14[B]	0.16[B]	0.15[B]
Uranium	µg/L	15	20	MAC	-	-	0.023	0.54[B]	0.23[B]	0.38[B]	0.35[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.25	0.84[B]	0.84[B]	0.84[B]	0.81[B]
Zinc	µg/L	7[k]	5000	AO	1200	-	1.2	2.6[B]	2.1[B]	2.2[B]	2.1[B]

[a] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[b] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of °C (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
[c] = Guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[d] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.
[e] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
[f] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.
[g] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[h] = Guidline is for hexavalent chromium.
[i] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).
[j] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).
[k] = Guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.

[C] = concentration is higher than the chronic aquatic life guideline or outside the recommended pH, DO or total alkalinity range.
[D] = concentration is higher than the human health-based guideline.
[S] = concentration is higher than the Site-specific Water Quality Objective (SSWQO) developed for the Whale Tail Project (Volume 6, Appendix 6-N) guideline.
[B] = Concentration higher than the relevant baseline level, or beyond the reccomended pH or DO concentration range.
Bolded values represent constituents of potential concern (COPC
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi*after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceeda
- = no guideline or no data

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Table 10: Lake A12 - Operations, Closure, and Post-Closure (Expansion Project

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (A15/A12)	A12 (Operations)	A12 (Closure)	A12 (Early Post-closure)	A12 (Late Post-closure)
		Aquatic Life	Human Health					Maximum Concentration	Maximum Concentration	Maximum Concentration	Maximum Concentration
		CCME Chronic	Health Canada		U.S. EPA RSL						
Conventional Parameters											
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	75	21	15	14
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	105	38	26	24
Major Ions											
Calcium	mg/L	-	NR	-	-	-	2.5	26[B]	5.9[B]	4.2[B]	3.9[B]
Chloride	mg/L	120	250	AO	-	-	2.1	49[B]	9.2[B]	5.2[B]	4.7[B]
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.025	0.068[B]	0.052[B]	0.063[B]	0.059[B]
Magnesium	mg/L	-	NR	-	-	-	0.89	2.3[B]	1.4[B]	1.2[B]	1.1[B]
Potassium	mg/L	-	-	-	-	-	0.58	1.4[B]	1.3[B]	1.4[B]	1.3[B]
Sodium	mg/L	-	200	AO	-	-	0.67	5.2[B]	2.8[B]	2.0[B]	1.7[B]
Sulphate	mg/L	128-218[a,f]	500	AO	-	-	3.3	7.1[B]	5.4[B]	5.2[B]	4.6[B]
Nutrients											
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.014	1.3[B]	1.3[B]	0.31[B]	0.24[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.0071	**0.13**[C, B]	**0.13**[C, B]	**0.042**[C, B]	**0.033**[C, B]
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0010	**0.020**[C, B]	**0.012**[C, B]	0.010[B]	0.0086[B]
Dissolved Metals											
Aluminum	µg/L	100[c]	100	AO	4000	-	3.2	4.7[B]	4.7[B]	1.6	1.5
Antimony	µg/L	9[d]	6	MAC	-	-	0.050	0.53[B]	0.53[B]	0.48[B]	0.43[B]
Arsenic	µg/L	5	10	MAC	-	25[e]	0.32	**13**[C, D, B]	**12**[C, D, B]	**20**[C, D, B]	**17**[C, D,B]
Barium	µg/L	1000[d]	1000	MAC	-	-	6.1	15[B]	10[B]	10[B]	9.0[B]
Beryllium	µg/L	0.13[d]	-	-	5	-	0.010	0.029[B]	0.027[B]	0.025[B]	0.024[B]
Bismuth	µg/L	0.7[f]	-	-	-	-	0.025	0.062[B]	0.062[B]	0.056[B]	0.055[B]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	72[B]	44[B]	30[B]	26[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.0025	0.014[B]	0.010[B]	0.010[B]	0.0093[B]
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.050	0.66[B]	0.42[B]	0.28[B]	0.24[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.050	0.55[B]	0.41[B]	0.42[B]	0.36[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	0.79	1.3[B]	1.1[B]	0.95[B]	0.86[B]
Iron	µg/L	300	300	AO	2800	-	5.0	60[B]	35[B]	44[B]	38[B]
Lead	µg/L	1.0[g]	10	MAC	-	-	0.025	0.29[B]	0.19[B]	0.16[B]	0.14[B]
Lithium	µg/L	-	-	-	8	-	0.50	2.2[B]	1.8[B]	1.6[B]	1.5[B]
Manganese	µg/L	1700[g]	50	AO	86	-	0.58	**89**[D, B]	**63**[D, B]	**74**[D, B]	**58**[D, B]
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0025	0.0082[B]	0.0081[B]	0.0094[B]	0.0091[B]
Molybdenum	µg/L	73	-	-	20	-	0.025	1.4[B]	0.55[B]	0.78[B]	0.72[B]
Nickel	µg/L	25[g]	-	-	78	-	0.65	5.3[B]	4.3[B]	3.9[B]	3.2[B]
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.25[B]	0.20[B]	0.16[B]	0.14[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.018[B]	0.017[B]	0.014[B]	0.014[B]
Strontium	µg/L	-	-	-	2400	-	11	51[B]	32[B]	25[B]	23[B]
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.015[B]	0.014[B]	0.014[B]	0.013[B]
Tin	µg/L	3[f]	-	-	2400	-	0.12	0.14[B]	0.14[B]	0.16[B]	0.15[B]
Uranium	µg/L	15	20	MAC	-	-	0.023	0.48[B]	0.22[B]	0.36[B]	0.34[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.25	0.83[B]	0.83[B]	0.84[B]	0.81[B]
Zinc	µg/L	7[k]	5000	AO	1200	-	1.2	2.4[B]	2.1[B]	2.2[B]	2.1[B]

[a] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[b] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of °C (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
[c] = Guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[d] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.
[e] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
[f] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.
[g] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[h] = Guidline is for hexavalent chromium.
[i] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).
[j] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada,
[k] = Guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.

[C] = concentration is higher than the chronic aquatic life guideline or outside the recommended pH, DO or total alkalinity range.
[D] = concentration is higher than the human health-based guideline.
[S] = concentration is higher than the Site-specific Water Quality Objective (SSWQO) developed for the Whale Tail Project (Volume 6, Appendix 6-N) guideline.
[B] = Concentration higher than the relevant baseline level, or beyond the reccomended pH or DO concentration range.
Bolded values represent constituents of potential concern (COPC
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi*after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceeda
- = no guideline or no data

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Table 11: Lake A76 - Operations, Closure, and Post-Closure (Expansion Project

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (A76)	A76 (Operations)	A76 (Closure)	A76 (Early Post-closure)	A76 (Late Post-closure)
		Aquatic Life	Human Health								
		CCME Chronic	Health Canada		U.S. EPA RSL			Maximum Concentration	Maximum Concentration	Maximum Concentration	Maximum Concentration
Conventional Parameters											
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	50	21	15	14
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	70	36	25	23
Major Ions											
Calcium	mg/L	-	NR	-	-	-	3.8	17[B]	6.2[B]	4.1[B]	3.8[B]
Chloride	mg/L	120	250	AO	-	-	5.3	31[B]	9.6[B]	4.7	4.4
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.034	0.057[B]	0.049[B]	0.059[B]	0.058[B]
Magnesium	mg/L	-	NR	-	-	-	1.3	1.8[B]	1.4[B]	1.2	1.1
Potassium	mg/L	-	-	-	-	-	0.84	1.2[B]	1.1[B]	1.3[B]	1.3[B]
Sodium	mg/L	-	200	AO	-	-	0.80	3.6[B]	2.5[B]	1.8[B]	1.7[B]
Sulphate	mg/L	128-218[a,f]	500	AO	-	-	3.8	5.6[B]	4.8[B]	4.9[B]	4.6[B]
Nutrients											
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.0058	0.89[B]	0.89[B]	0.26[B]	0.22[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.013	**0.085[C, B]**	**0.085[C, B]**	**0.037[C, B]**	**0.031[C, B]**
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0012	**0.014[C, B]**	0.010[B]	0.0090[B]	0.0081[B]
Dissolved Metals											
Aluminum	µg/L	100[c]	100	AO	4000	-	2.6	4.7[B]	4.9[B]	2.5	2.0
Antimony	µg/L	9[d]	6	MAC	-	-	0.050	0.43[B]	0.43[B]	0.43[B]	0.41[B]
Arsenic	µg/L	5	10	MAC	-	25[e]	0.23	**9.1[C, B]**	**9.1[C, B]**	**17[C, D, B]**	**16[C, D, B]**
Barium	µg/L	1000[d]	1000	MAC	-	-	8.0	12[B]	9.9[B]	9.7[B]	9.2[B]
Beryllium	µg/L	0.13[d]	-	-	5	-	0.010	0.028[B]	0.028[B]	0.026[B]	0.025[B]
Bismuth	µg/L	0.7[f]	-	-	-	-	0.025	0.063[B]	0.065[B]	0.059[B]	0.058[B]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	52[B]	38[B]	28[B]	25[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.014	0.012	0.0099	0.0098	0.0093
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.050	0.48[B]	0.36[B]	0.26[B]	0.24[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.071	0.41[B]	0.35[B]	0.38[B]	0.34[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	0.66	1.1[B]	1.0[B]	0.93[B]	0.89[B]
Iron	µg/L	300	300	AO	2800	-	5.0	46[B]	33[B]	39[B]	37[B]
Lead	µg/L	1.0[g]	10	MAC	-	-	0.14	0.22[B]	0.17[B]	0.15[B]	0.14[B]
Lithium	µg/L	-	-	-	8	-	0.50	1.9[B]	1.7[B]	1.6[B]	1.6[B]
Manganese	µg/L	1700[g]	50	AO	86	-	1.2	**58[D, B]**	49[B]	**62[D, B]**	**53[D, B]**
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0035	0.0078[B]	0.0078[B]	0.0091[B]	0.0090[B]
Molybdenum	µg/L	73	-	-	20	-	0.025	0.95[B]	0.49[B]	0.66[B]	0.65[B]
Nickel	µg/L	25[g]	-	-	78	-	0.99	3.7[B]	3.4[B]	3.4[B]	3.0[B]
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.18[B]	0.17[B]	0.15[B]	0.14[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.017[B]	0.016[B]	0.014[B]	0.014[B]
Strontium	µg/L	-	-	-	2400	-	23	37[B]	29[B]	24[B]	22
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.014[B]	0.014[B]	0.014[B]	0.014[B]
Tin	µg/L	3[f]	-	-	2400	-	0.050	0.15[B]	0.16[B]	0.16[B]	0.16[B]
Uranium	µg/L	15	20	MAC	-	-	0.017	0.32[B]	0.19[B]	0.31[B]	0.30[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.25	0.79[B]	0.79[B]	0.83[B]	0.81[B]
Zinc	µg/L	7[k]	5000	AO	1200	-	2.5	2.1	1.9	2.1	2.0

[a] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[b] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of °C (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
[c] = Guideline is pH dependent. The guideline range shown is based on an assumed pH value of more than or equal to 6.5, which is comparable to baseline values determined in the receiving environment.
[d] = In the absence of CCME guidelines, the BC MOE working water quality guideline was used.
[e] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
[f] = In the absence of a CCME guideline, the ANZECC 2000 guideline was used.
[g] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
[h] = Guidline is for hexavalent chromium.
[i] = In the absence of CCME guidelines, the Federal Environmental Quality Guideline was used (Environment Canada 2013).
[j] = In the absence of CCME guidelines, the EC/HC predicted no effect concentration (PNEC) for freshwater organisms was used (Environment Canada/Health Canada, 2010).
[k] = Guideline is hardness, dissolved organic carbon, and pH dependent. The guideline value shown is based on hardness of 23.4 mg/L, dissolved organic carbon of 1.7 mg/L, and pH of 7.2. Guideline for each prediction was determined using predicted hardness, minimum dissolved organic carbon from the measured baseline, and 95th percentile pH from the measured baseline.

[C] = concentration is higher than the chronic aquatic life guideline or outside the recommended pH, DO or total alkalinity range.
[D] = concentration is higher than the human health-based guideline.
[S] = concentration is higher than the Site-specific Water Quality Objective (SSWQO) developed for the Whale Tail Project (Volume 6, Appendix 6-N) guideline.
[B] = Concentration higher than the relevant baseline level, or beyond the reccomended pH or DO concentration range.
Bolded values represent constituents of potential concern (COPC
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precisi*after* comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Concentrations equal to the guideline values were not identified as exceeda
- = no guideline or no data

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Table 12: Node DS1 - Operations, Closure, and Post-Closure (Expansion Project

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (DS1)	DS1 (Operations)	DS1 (Closure)	DS1 (Early Post-closure)	DS1 (Late Post-closure)
		Aquatic Life	Human Health					Maximum Concentration	Maximum Concentration	Maximum Concentration	Maximum Concentration
		CCME Chronic	Health Canada		U.S. EPA RSL						
Conventional Parameters											
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	13	8.9	8.6	8.5
Total dissolved solids (calculat	mg/L	-	500	AO	-	-	-	18	13	13	12
Major Ions											
Calcium	mg/L	-	NR	-	-	-	3.4	3.9[B]	2.4	2.3	2.2
Chloride	mg/L	120	250	AO	-	-	2.4	4.9[B]	2.1	1.7	1.6
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.055	0.031	0.029	0.031	0.031
Magnesium	mg/L	-	NR	-	-	-	1.1	0.81	0.71	0.72	0.72
Potassium	mg/L	-	-	-	-	-	0.75	0.58	0.54	0.60	0.60
Sodium	mg/L	-	200	AO	-	-	1.4	1.0	0.81	0.82	0.80
Sulphate	mg/L	128[a]	500	AO	-	-	2.8	2.6	2.4	2.5	2.5
Nutrients											
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.029	0.10[B]	0.082[B]	0.043[B]	0.037[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.010	0.015[B]	0.012[B]	0.0098	0.0091
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0012	0.0037[B]	0.0028[B]	0.0031[B]	0.0030[B]
Dissolved Metals											
Aluminum	µg/L	100[c]	100	AO	4000	-	7.2	3.9	3.9	3.6	3.6
Antimony	µg/L	9[d]	6	MAC	-	-	0.24	0.14	0.13	0.15	0.15
Arsenic	µg/L	5	10	MAC	-	25[e]	0.19	1.2[B]	0.95[B]	2.5[B]	2.3[B]
Barium	µg/L	1000[d]	1000	MAC	-	-	6.9	6.5	5.9	6.2	6.1
Beryllium	µg/L	0.13[d]	-	-	5	-	0.010	0.021[B]	0.021[B]	0.021[B]	0.021[B]
Bismuth	µg/L	0.7[f]	-	-	-	-	0.025	0.053[B]	0.052[B]	0.052[B]	0.052[B]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	16[B]	13[B]	13[B]	12[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.037	0.0061	0.0056	0.0059	0.0059
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.078	0.15[B]	0.12[B]	0.12[B]	0.12[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.050	0.14[B]	0.12[B]	0.14[B]	0.14[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	1.4	0.68	0.64	0.66	0.65
Iron	µg/L	300	300	AO	2800	-	31	17	14	16	16
Lead	µg/L	1.0[g]	10	MAC	-	-	5.1	0.084	0.073	0.076	0.074
Lithium	µg/L	-	-	-	8	-	0.50	1.1[B]	1.1[B]	1.1[B]	1.1[B]
Manganese	µg/L	1700[g]	50	AO	86	-	1.5	8.1[B]	4.9[B]	8.9[B]	8.1[B]
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0025	0.0054[B]	0.0053[B]	0.0056[B]	0.0057[B]
Molybdenum	µg/L	73	-	-	20	-	0.029	0.17[B]	0.093[B]	0.13[B]	0.14[B]
Nickel	µg/L	25[g]	-	-	78	-	0.99	0.97	0.79	0.94	0.89
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.068[B]	0.060[B]	0.064[B]	0.063[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.011[B]	0.011[B]	0.011[B]	0.011[B]
Strontium	µg/L	-	-	-	2400	-	15	13	10	11	11
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.011[B]	0.010[B]	0.011[B]	0.011[B]
Tin	µg/L	3[f]	-	-	2400	-	0.050	0.14[B]	0.14[B]	0.14[B]	0.14[B]
Uranium	µg/L	15	20	MAC	-	-	0.036	0.064[B]	0.041[B]	0.063[B]	0.065[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.25	0.54[B]	0.53[B]	0.55[B]	0.55[B]
Zinc	µg/L	7[k]	5000	AO	1200	-	7.6	1.2	1.1	1.2	1.2

[a] = In the absence of CCME guidelines, the BC MOE water quality guideline was used.
[b] = The guideline shown is for unionized ammonia. Model predictions were for total ammonia. For each prediction, the proportion of predicted total ammonia that would be unionized ammonia was based on the assumption of pH of 7 and water temperature of °C (receiving environment) and pH of 8.5 and water temperature of 15.0ºC (effluent)
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[e] = Value provided is the Site-Specific Water Quality Objective (SSWQO) derived for the Meadowbank Mine.
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[g] = Guideline is hardness dependent. The guideline range shown is based on the hardness range observed in the dataset (9 to 44 mg/L). The guideline is calculated based on the individual hardness value for each sample.
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Table 13: Node DS2 - Operations, Closure, and Post-Closure (Expansion Project

Parameter	Unit	Selected Screening Values				Site-Specific Water Quality Objective	Baseline (DS1)	DS2 (Operations)	DS2 (Closure)	DS2 (Early Pos	DS2 (Late Post-closure)
		Aquatic Life	Human Health					Maximum Concentration	Maximum Concentration	Maximum Concentration	Maximum Concentration
		CCME Chronic	Health Canada		U.S. EPA RSL						
Conventional Parameters											
Hardness, as $CaCO_3$	mg/L	-	NR	-	-	-	-	44	15	12	12
Total dissolved solids (calculated	mg/L	-	500	AO	-	-	-	61	24	20	19
Major Ions											
Calcium	mg/L	-	NR	-	-	-	3.4	15[B]	4.1[B]	3.4	3.2
Chloride	mg/L	120	250	AO	-	-	2.4	26[B]	5.5[B]	3.6[B]	3.3[B]
Fluoride	mg/L	0.12	1.5	MAC	-	-	0.055	0.052	0.039	0.048	0.047
Magnesium	mg/L	-	NR	-	-	-	1.1	1.6[B]	1.0	0.99	0.95
Potassium	mg/L	-	-	-	-	-	0.75	1.0[B]	0.82[B]	1.0[B]	1.0[B]
Sodium	mg/L	-	200	AO	-	-	1.4	3.2[B]	1.6[B]	1.4[B]	1.3
Sulphate	mg/L	128[a,f]	500	AO	-	-	2.8	5.1[B]	3.6[B]	4.0[B]	3.8[B]
Nutrients											
Nitrate	mg-N/L	2.9	10	MAC	-	-	0.029	0.62[B]	0.48[B]	0.18[B]	0.15[B]
Total ammonia	mg-N/L	0.019[b]	NR	-	-	-	0.010	**0.067[C, B]**	**0.048[C, B]**	**0.027[C, B]**	**0.023[C, B]**
Dissolved phosphorus	mg-P/L	0.010	-	-	-	-	0.0012	**0.012[C, B]**	0.0065[B]	0.0067[B]	0.0062[B]
Dissolved Metals											
Aluminum	µg/L	100[c]	100	AO	4000	-	7.2	4.4	4.4	3.5	3.4
Antimony	µg/L	9[d]	6	MAC	-	-	0.24	0.31[B]	0.28[B]	0.32[B]	0.31[B]
Arsenic	µg/L	5	10	MAC	-	25[e]	0.19	**7.0[C, B]**	**5.0[C, B]**	**11[C, D, B]**	**11[C, D, B]**
Barium	µg/L	1000[d]	1000	MAC	-	-	6.9	11[B]	7.8[B]	8.4[B]	7.9[B]
Beryllium	µg/L	0.13[d]	-	-	5	-	0.010	0.027[B]	0.024[B]	0.024[B]	0.024[B]
Bismuth	µg/L	0.7[f]	-	-	-	-	0.025	0.059[B]	0.058[B]	0.057[B]	0.056[B]
Boron	µg/L	1,500	5,000	MAC	-	-	5.0	45[B]	25[B]	22[B]	20[B]
Cadmium	µg/L	0.18 - 0.90[g]	5.0	MAC	-	-	0.037	0.011	0.0077	0.0083	0.0079
Chromium	µg/L	1.0[h]	50[g]	MAC	-	-	0.078	0.42[B]	0.24[B]	0.21[B]	0.19[B]
Cobalt	µg/L	2.5[i]	-	-	1.2	-	0.050	0.36[B]	0.23[B]	0.28[B]	0.26[B]
Copper	µg/L	2.0[g]	1000	MAC	-	-	1.4	1.1	0.82	0.83	0.79
Iron	µg/L	300	300	AO	2800	-	31	40[B]	24	30	29
Lead	µg/L	1.0[g]	10	MAC	-	-	5.1	0.19	0.12	0.12	0.11
Lithium	µg/L	-	-	-	8	-	0.50	1.8[B]	1.4[B]	1.4[B]	1.4[B]
Manganese	µg/L	1700[g]	50	AO	86	-	1.5	48[B]	26[B]	41[B]	36[B]
Mercury	µg/L	0.026	1.0	MAC	-	-	0.0025	0.0073[B]	0.0065[B]	0.0078[B]	0.0077[B]
Molybdenum	µg/L	73	-	-	20	-	0.029	0.82[B]	0.28[B]	0.45[B]	0.46[B]
Nickel	µg/L	25[g]	-	-	78	-	0.99	3.2[B]	2.0[B]	2.5[B]	2.2[B]
Selenium	µg/L	1.0	50	MAC	-	-	0.025	0.16[B]	0.11[B]	0.11[B]	0.11[B]
Silver	µg/L	0.25	NR	-	-	-	0.0050	0.016[B]	0.013[B]	0.013[B]	0.013[B]
Strontium	µg/L	-	-	-	2400	-	15	33[B]	19[B]	19[B]	18[B]
Thallium	µg/L	0.80	-	-	0.04	-	0.0050	0.013[B]	0.012[B]	0.013[B]	0.013[B]
Tin	µg/L	3[f]	-	-	2400	-	0.050	0.15[B]	0.15[B]	0.16[B]	0.16[B]
Uranium	µg/L	15	20	MAC	-	-	0.036	0.27[B]	0.11[B]	0.21[B]	0.21[B]
Vanadium	µg/L	120[j]	-	-	17	-	0.25	0.70[B]	0.66[B]	0.72[B]	0.71[B]
Zinc	µg/L	7[k]	5000	AO	1200	-	7.6	1.9	1.5	1.7	1.7

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